CIVIL ENGINEERING

THE MAGAZINE OF ENGINEERED CONSTRUCTION • JULY 1961

AMERICAN SOCIETY OF CIVIL ENGINEERS FOUNDED 1852

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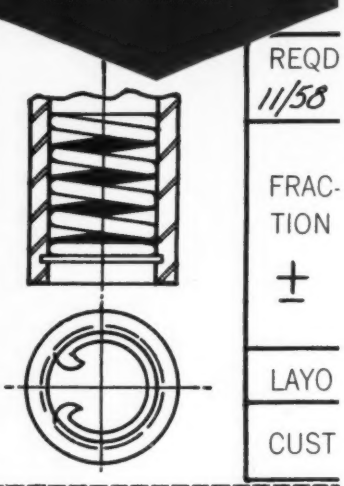

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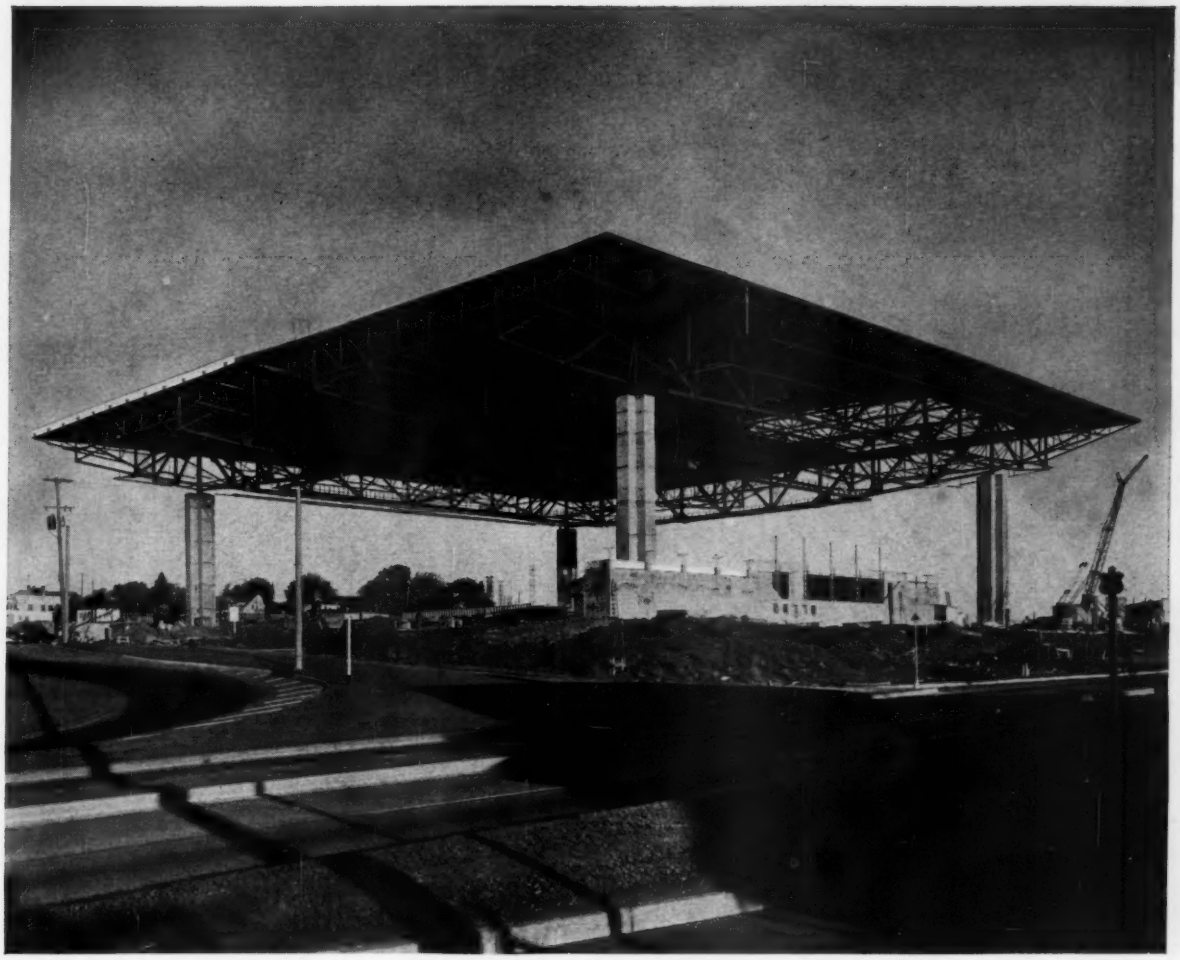

Owner: Portland Exposition Recreation Commission; Architect: Skidmore, Owings & Merrill; Structural engineer: Moffatt, Nichol & Taylor; General contractor: Hoffman Construction Co.; Structural steel fabricator: Poole, McGonigle, and Dick

They raised the roof two weeks ahead of schedule

This roof contains 1,250 tons of Bethlehem structural steel. Erected with some 35,000 Bethlehem high-strength bolts, it was completed two weeks ahead of schedule.

The designers of the building (Memorial Coliseum for the City of Portland, Oregon) reversed the usual scheme of starting from the ground —up. With the roof erected first for protection against bad weather, walls and interior were completed during the winter months.

Bolting is fast, economical, quiet

Bolting is quiet, requires only a two-man crew . . . which needs little training. There's no fire hazard. No tossing of hot rivets. And the work goes fast.

We ship bolts promptly . . . from large stocks

Bethlehem can make fast delivery of new specification high-strength bolts in all popular sizes. Give us your order and watch us go into action. The nearest Bethlehem office can give you the whole story.

Steel

for Strength
. . . Economy
. . . Versatility

BETHLEHEM STEEL COMPANY, BETHLEHEM, PA.
Export Sales: Bethlehem Steel Export Corporation

BETHLEHEM STEEL

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Insures correct dimensions, fit, and placement . . . .

1. A shop drawing of the job is submitted to the customer for approval, when necessary. This plan shows the size and shape of the grating area—how grating clears all obstructions.
2. Each finished panel is carefully checked for accuracy of dimensions.
3. Each panel is plainly marked with its number to insure quick, easy installation.
4. The entire platform is laid out on our shop floor. Overall dimensions and obstruction openings are checked against shop drawings.
5. Erection diagram showing panel mark numbers is supplied for field installation.

Write today for free 16-page catalog showing all basic types of grating; more than 30 dimensional drawings of subtypes; eight safe load tables for steel and aluminum grating.

BORDEN METAL PRODUCTS CO.

"Greatest name in gratings"

845 Green Lane Elizabeth 2-6410 Elizabeth, N. J.

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"Please send me NEW 1961 BORDEN catalog"

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TITLE .....
COMPANY NAME .....
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CITY AND STATE .....

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CIVIL ENGINEERING

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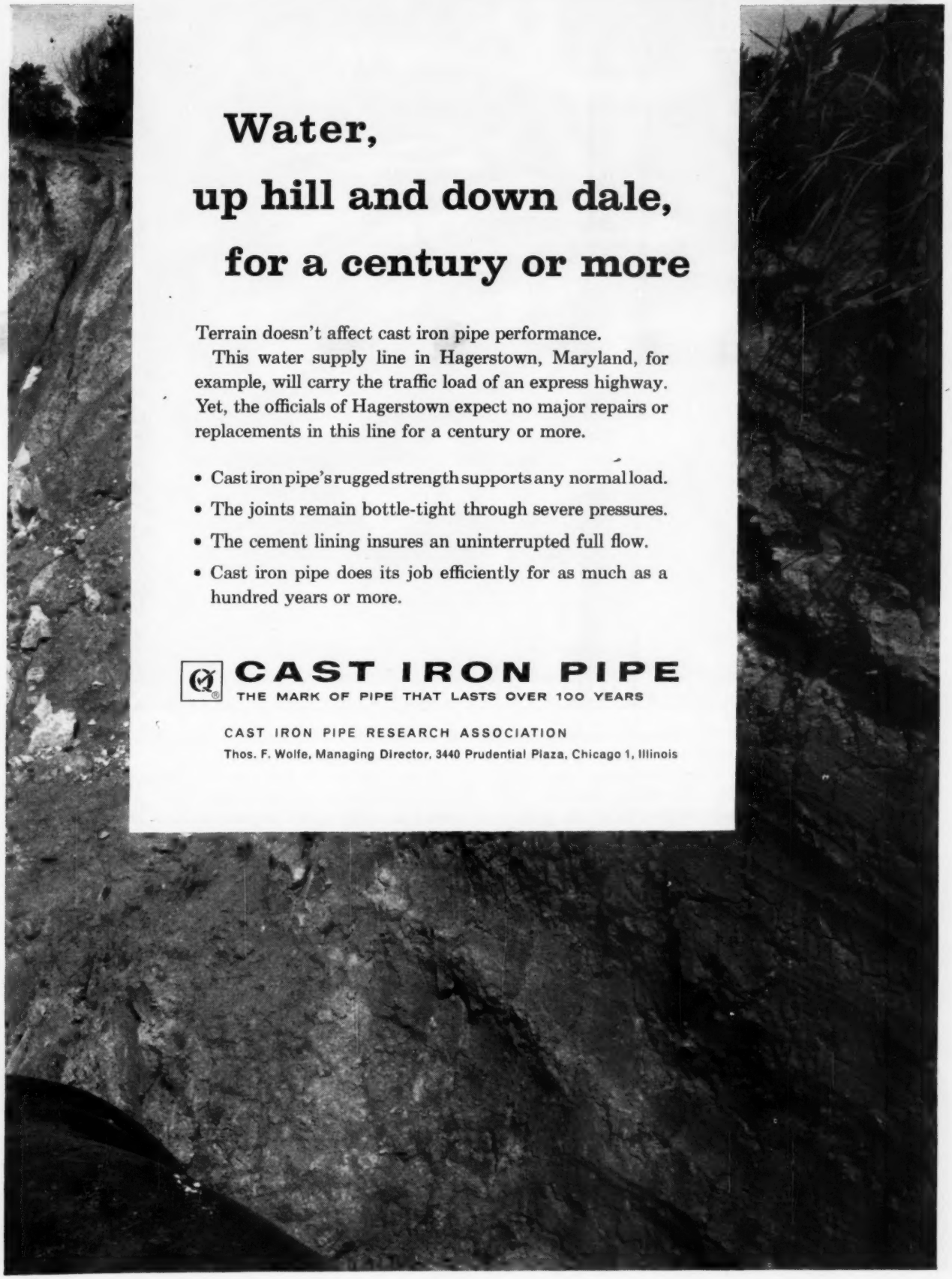
THE MAGAZINE OF ENGINEERED CONSTRUCTION

• *ARTICLES*

• *ASCE NEWS*

• *DEPARTMENTS*



Water, up hill and down dale, for a century or more

Terrain doesn't affect cast iron pipe performance.

This water supply line in Hagerstown, Maryland, for example, will carry the traffic load of an express highway. Yet, the officials of Hagerstown expect no major repairs or replacements in this line for a century or more.

- Cast iron pipe's rugged strength supports any normal load.
- The joints remain bottle-tight through severe pressures.
- The cement lining insures an uninterrupted full flow.
- Cast iron pipe does its job efficiently for as much as a hundred years or more.

CAST IRON PIPE

THE MARK OF PIPE THAT LASTS OVER 100 YEARS

CAST IRON PIPE RESEARCH ASSOCIATION

Thos. F. Wolfe, Managing Director, 3440 Prudential Plaza, Chicago 1, Illinois

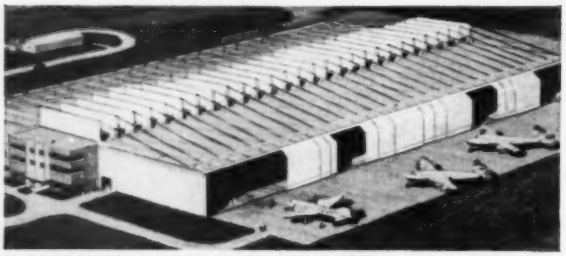
How to build
THE SHOPPING CENTER OF THE FUTURE—NOW!

In this shopping center of the future, the suspended roof would leave every square foot of interior space completely unobstructed. An artist's conception, yes — but this is no unattainable "dream building." Modern suspended roof techniques pioneered by Roebling make it practical and economical *now*.

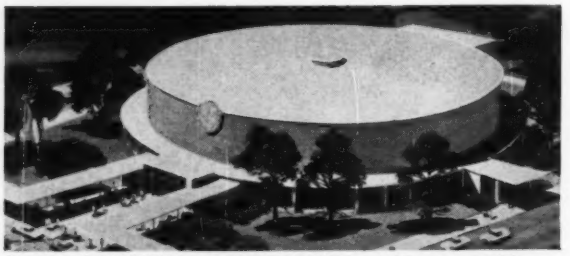
Consider the down-to-earth advantages. Floor space for supports would become paying space instead. Merchandise would be handled, displayed and sold with new ease and efficiency. Customer traffic would move faster with fewer obstructions. Add low first cost and the prospect becomes even more alluring!

Suspended roofs are paying off handsomely in many types of buildings — plants, gymnasiums, airline terminals and hangars, auditoriums, stadiums and others.

Roebling's great experience with steel in tension enables it to take an active leadership in the suspended roof field. This experience is available to you. For information please call or write Roebling's Bridge Division, Trenton 2, New Jersey.



SUSPENSION ROOFS NOW AT WORK . . .
TWA HANGAR – MID-CONTINENT INTERNATIONAL AIRPORT, KANSAS CITY • Designed by Burns & McDonnell, Kansas City • Ammann & Whitney, Consulting Engineers, New York City • Contractors: MacDonald-Creighton, St. Louis and Nashville • Cables by Roebling



UTICA MEMORIAL AUDITORIUM, N. Y. • Architects: Gehron & Seltzer, New York City • Associate Architect: Frank C. Delle Cese, Utica • Consulting Engineer: Dr. Lev Zetlin, New York City • Contractor: Sovereign Construction Company, Ltd., Fort Lee, N. J. • Roof Supporting Structure, Including Cables, Furnished and Erected by Roebling

ROEBLING

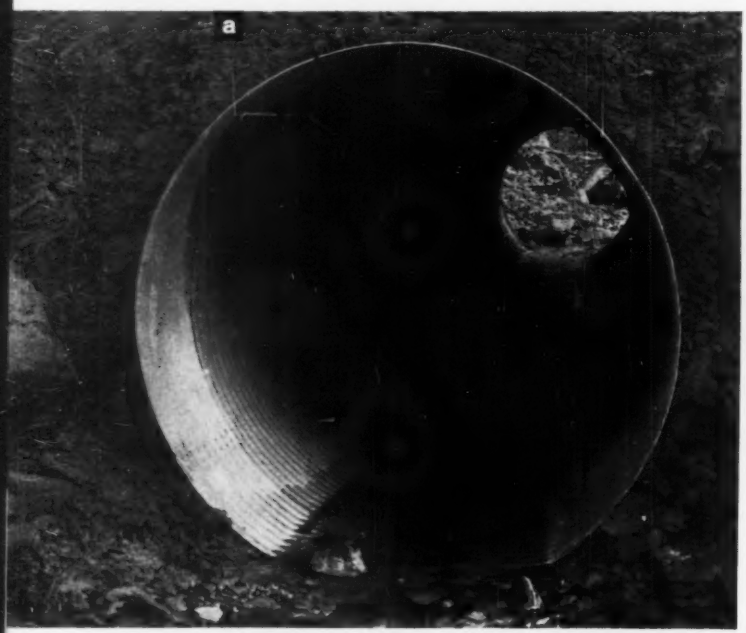
Branch Offices in Principal Cities • John A. Roebling's Sons Division • The Colorado Fuel and Iron Corporation

In 1775, Daniel Boone hacked his way through the forests of Kentucky and left a wake that was to become known to pioneers as "Wilderness Road." It was Kentucky's first highway, built by one man's time, courage and energy. Today, thousands of men are still changing Kentucky's terrain, building modern, safe highways of concrete and steel. In the next three years, Kentucky will spend more than $126 million in matching funds on its share of the National System of Interstate Highways. Kentucky has already completed 82 miles of new Interstate roads and another 115 miles are under construction. When completed, Kentucky will have 709 miles of Interstate Highway. For more details on Kentucky's Interstate Highway progress, turn the page.

The strength of Kentucky's Interstate Highway program is steel

More than 160 million cubic yards of dirt will be dug, dozed, drawn and dumped with steel equipment. Power shovels equipped with USS High Strength Steel buckets will shatter mountains of rock and shale. Giant steel tractors and paving equipment will spread more than 17 million square yards of pavement. And for maximum strength, the pavement will be reinforced with steel reinforcing bars or steel fabric. 250 overpasses will depend on the strength of steel for permanence. Rights-of-way will be protected with more than a thousand miles of fencing, almost enough to enclose the whole state. Two million feet of steel guardrail will line the highway. Steel is also used for highway signs, posts and lighting standards.

USS Steel H-Beam Bearing Piles were driven to rock as deep as 105 feet to get a sure footing for four bridges on the Covington-Lexington section of Interstate 75. Kentucky's share of the Nation's 41,000 miles of Interstate Highway is under the direction of Henry Ward, Highway Commissioner, and D. H. Bray, Highway Engineer.



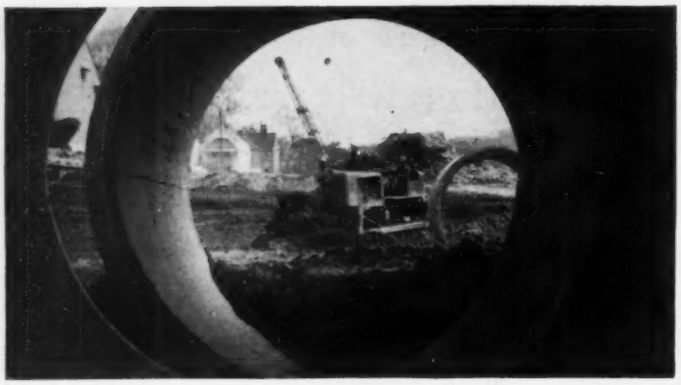
a Steel culvert, below, protects road embankments by shuttling thousands of streams harmlessly underneath. Steel culvert is strong, economical and long lasting. **b** Steel anchors on steel girders (d), hold roadways tight and firm, for composite action. **c** Construction machinery is built from more than 150 varieties of steel for high strength and all-weather performance. Nothing can match the strength and durability of steel for construction equipment. **d** Giant steel girders will keep traffic moving endlessly. Steel bridges outlast everything but route changes. **e** Steel reinforced highways last longer, ride smoother and cost less to maintain. USS reinforcing rod and fabric is made from cold-drawn high strength steel for maximum strength. **f** Highway accessories, guardrails, lighting standards and signs look attractive with minimum maintenance and last for a long time. **g** Proposed interstate highway route locations for Kentucky's 709 miles of the Nation's Interstate Highway Program. **Right,** Governor Bert T. Combs looks over plans for new roads to tie in with Kentucky's share of the Interstate Highway Program. USS and AMERICAN are registered trademarks.

United States Steel

USS

This mark tells you a product is made of modern, dependable Steel.

Steel piles, left, being driven for the Covington-Lexington section of Interstate 75. More than 82,000 feet of USS H-Beam Bearing Pile was driven for four bridges in this section. **Completed Interstate,** below, winds through picturesque Kentucky scenery, and every foot of highway is made stronger with steel.



Reinforced concrete pipe is 30% stronger when it's reinforced with USS AMERICAN Welded Wire Fabric. Steel fabric distributes the load evenly and reduces stress about one third. **Reinforcing bars,** right, provide the backbone for bridge superstructure. Every bridge in the Kentucky Interstate Highway Program depends on the strength of steel.

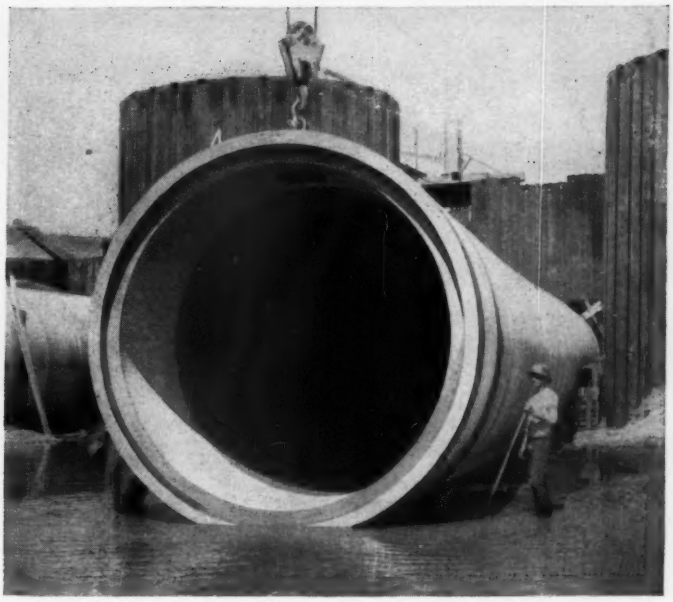
Send for U. S. Steel's *free* 54-page booklet, "Keep Our Roads on the Go." It tells how the complete range of highway products and services available from U. S. Steel cut costs and speeds operations in every phase of highway construction. United States Steel, 525 William Penn Place, Pittsburgh 30, Pennsylvania.

United States Steel

USS

The highway market also is served by the following divisions of United States Steel: American Bridge Division • American Steel and Wire Division • Columbia-Geneva Steel Division • Consolidated Western Steel Division • National Tube Division • Tennessee Coal & Iron Division • Universal Atlas Cement Division • United States Steel Supply Division.

BIG



CONCRETE PIPE BY AMERICAN-MARIETTA

American-Marietta 144" reinforced concrete pipe installation used by Ohio Edison Co. for a triple discharge line over 1000 feet long at Stratton, Ohio.

A-M trucks delivering concrete pipe directly to the job site. Nationwide location of plants assures quick delivery of your order by truck, rail or barge.

Another example of
PROGRESS IN CONCRETE

BIG diameter reinforced concrete pipe—delivered to the job in quantity—calls for a manufacturer with BIG facilities. American-Marietta not only has the necessary equipment and engineering background to produce such pipe in quantity, but the ability to deliver it *when* and *where* needed from any of its many plants located strategically from coast to coast.

So if you're thinking BIG—about a BIG job with BIG savings in time and money—think of AMERICAN-MARIETTA COMPANY.

Our technical staff will be pleased to assist you with your pipe problems.

AMERICAN-MARIETTA COMPANY
CONCRETE PRODUCTS DIVISION
GENERAL OFFICES:
AMERICAN-MARIETTA BUILDING
101 EAST ONTARIO STREET, CHICAGO 11, ILLINOIS, PHONE: WHITEHALL 4-5600

Cubic DM-20 Electrotape system quickly pinpoints location of off-shore installation.

ELECTROTAPE WORKS WHERE CHAIN AND TAPE WON'T: The new, lightweight, all-transistorized version of Cubic Electrotape, Model DM-20, marks a major breakthrough in the art of surveying. Electrotape eliminates time-consuming chain and tape work, and lets even unskilled operators measure distances from 150 feet to 40 miles in just a few minutes per set-up. Easily operable by one man, the DM-20 weighs only 25 pounds. Its accuracy is 1 centimeter plus 3 parts per million, and the front panel readout is directly in centimeters, eliminating scope or meter interpretations. The DM-20 operates day and night, in any weather, with a built-in radio-telephone permitting communication between operators at all times. A single tripod-mounted unit incorporates the recessed parabolic antenna, regulated power supply, compact battery, and electronic circuits. Write for descriptive literature to Dept. CE-103, Industrial Division, Cubic Corporation, San Diego 11, California.

cubic CORPORATION

INDUSTRIAL DIVISION
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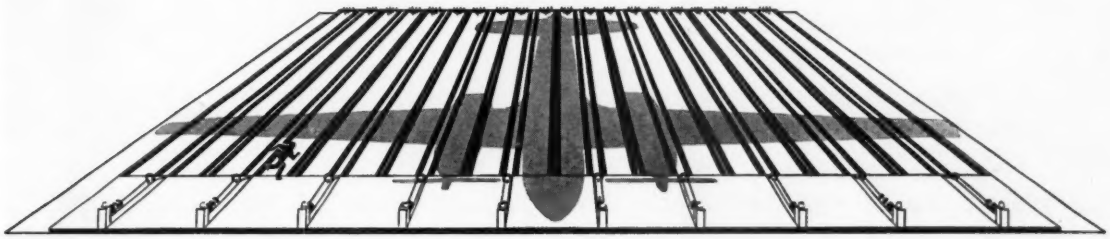
IN AIRCRAFT HANGARS OR BOWLING LANES...



Where maximum open floor space is a must... design and build with Macomber ALLSPANS!

See what you can put under 120-foot ALLSPANS! 20 regulation bowling lanes . . . or a Convair 440 . . . and all with room to spare. Get the many design and erection economies of open-web framing **plus** clear spans up to 120 feet—with ALLSPANS, the **longest, strongest** open web joists you can specify or buy!

Complete 28-page construction reference manual

- Dimensions
- Properties
- Load Tables
- Deflections
- Bridging
- Decking, etc.

Please send me your ALLSPAN Design Manual

NAME _____

COMPANY _____

POSITION _____

ADDRESS _____

CITY _____ ZONE _____ STATE _____

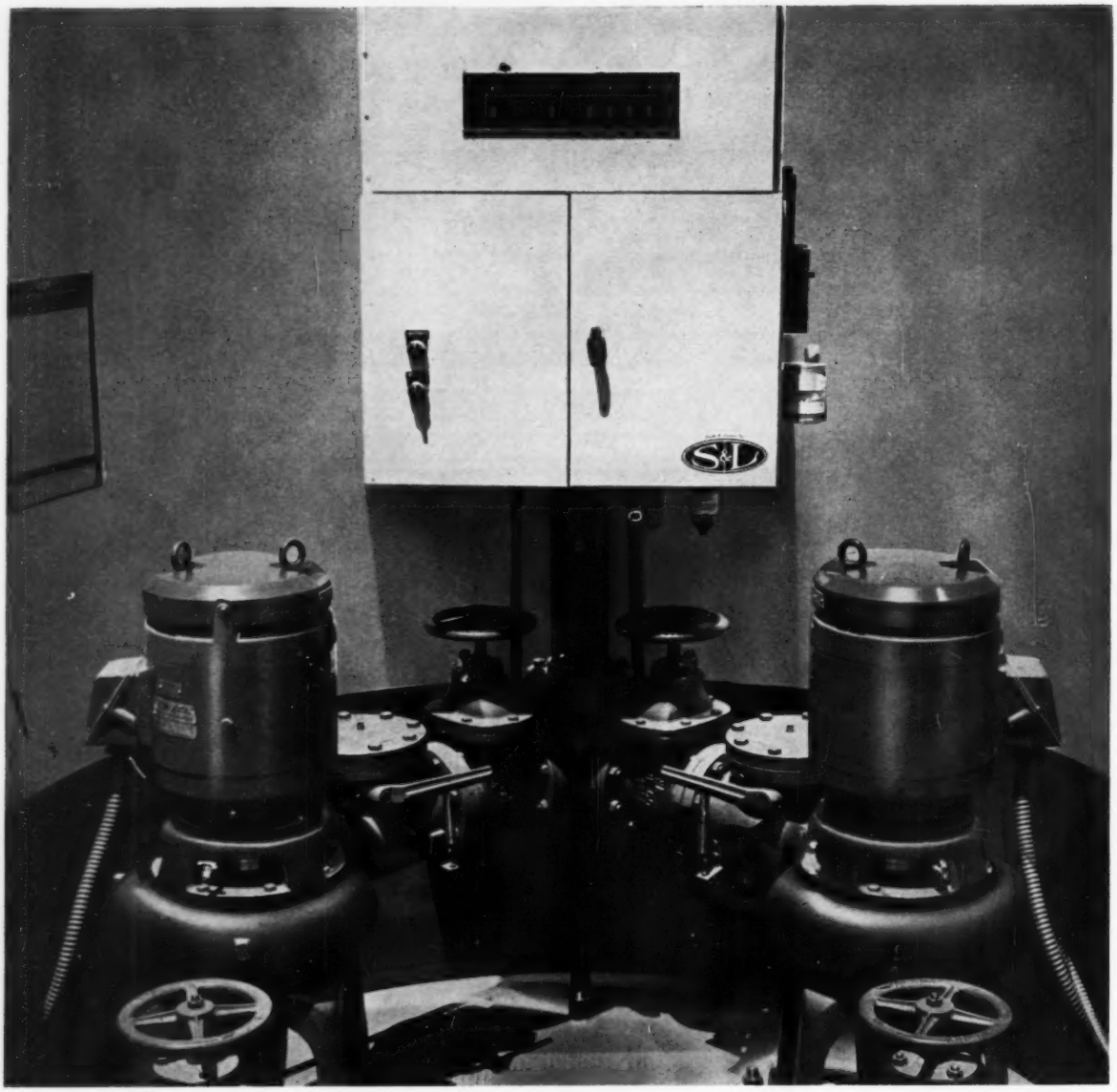
CE-617

MACOMBER
CANTON 1, OHIO

ALLSPANS • V-LOK • V-PURLINS
BOWSTRING TRUSSES • ROOF DECK • STRUCTURAL STEEL

Find Your Local MACOMBER Representative in the Yellow Pages

SEE OUR CATALOG IN SWEET'S OR WRITE FOR COPY



"PINNACLE OF PERFECTION" describes the Smith & Loveless Factory-Built Sewage Pumping Station . . . economical to install, clean, compact and built for automatic, efficient operation with minimum maintenance.

Over 1600 installations throughout the continent, Hawaii and Europe offer ample testimony to the wide acceptance of Smith & Loveless lift stations. Available in a variety of standard sizes — plus three and four-pump stations. Even larger capacity stations built to order.

Smith & Loveless Factory-Built Stations are the *only* ones offering the one pump designed to meet all the must requirements of sewage service—the Smith & Loveless "Non-Clog" Pump, a vertical, close-coupled pump with over-size shaft and bearings—and a "dead-tight" mechanical seal.

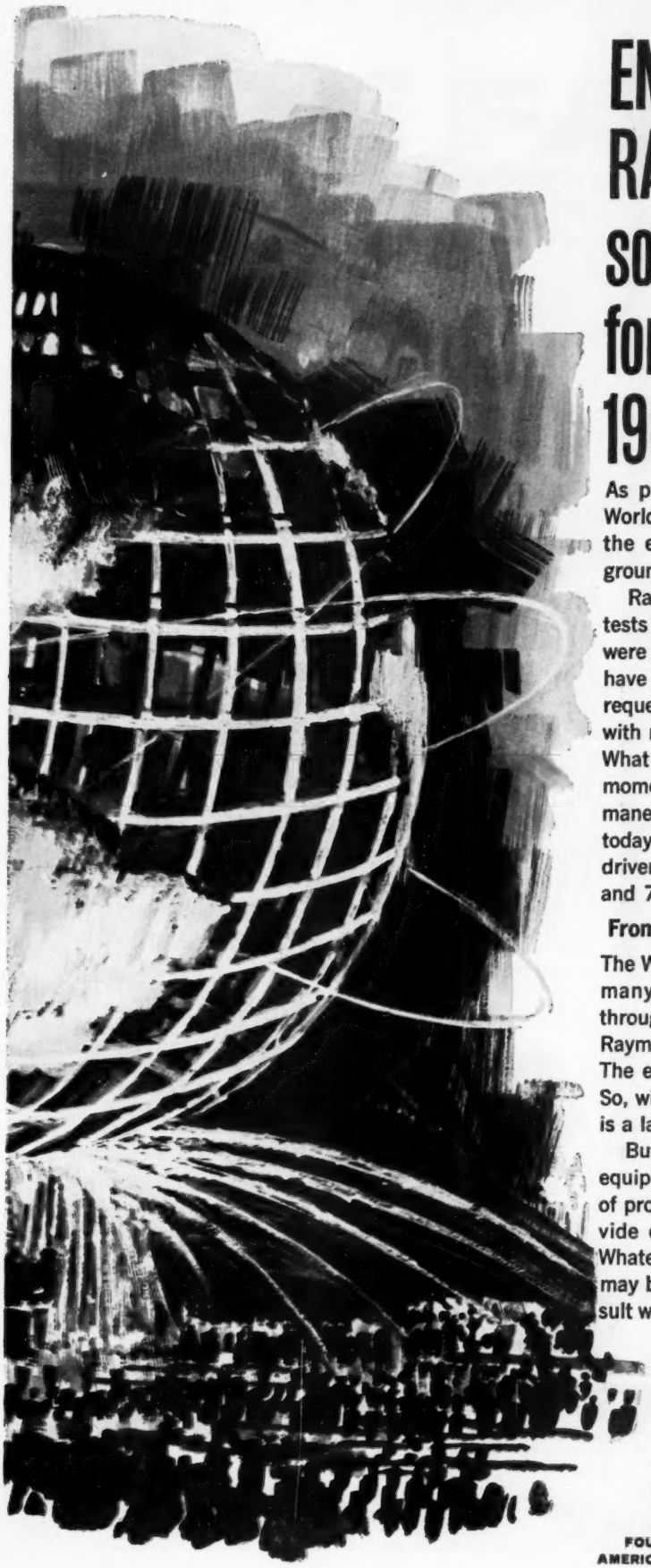
For information about how a Smith & Loveless Factory-Built Sewage Lift Station can fit into your sewerage project . . . write for complete engineering data, pump selection charts, drawings: Address Department 80.

Smith & Loveless

ONE OF THE UNION TANK CAR COMPANIES

P. O. BOX 8884/KANSAS CITY 15, MISSOURI/PLANT: LENEXA, KANSAS

(2825)



ENGINEERS: RAYMOND offers soil information for site of 1964 World's Fair

As plans take definite shape for the 1964-65 World's Fair at Flushing Meadows, Long Island, the engineering question arises—what's the ground like for foundations?

Raymond knows. Borings, soil tests, and pile tests for the 1939 World's Fair, on the same site, were made by Raymond under Contract #1. We have data on this area in our files, available on request to architects and engineers concerned with new construction for the forthcoming Fair. What you need we may be able to offer on a moment's notice. Just incidentally, the only permanent buildings of the 1939 Fair stand firmly today on Raymond foundations. 1,817 piles were driven for the Amphitheater & Island Stadium and 719 for the New York Exhibition building.

From the ground down—here and overseas

The World's Fair is only one example. In a great many areas of the States—and elsewhere throughout the Free World—chances are that Raymond has already made soil investigations. The experience of 64 years is readily at hand. So, with us, you will be that much ahead, which is a large step indeed.

But soil tests are only the prelude. We are equipped, too, to drive foundations for any type of project, anywhere in the country, and to provide complete construction services abroad. Whatever and wherever your construction plans may be, give us a call. We'll be pleased to consult with you.

CONCRETE PILE DIVISION

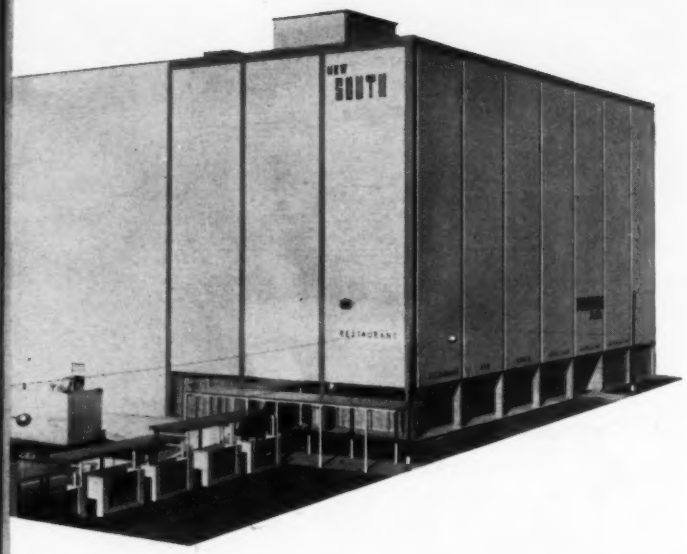
RAYMOND INTERNATIONAL INC.

140 CEDAR STREET, NEW YORK 6, N.Y.

Branch Offices in principal cities of the United States. Subsidiaries in Canada, Central and South America and other countries around the world.

FOUNDATIONS AND SPECIALIZED CONSTRUCTION IN AMERICA...COMPLETE CONSTRUCTION SERVICES ABROAD

High speed at High Point earns $150,000 ...with STEEL



STEEL brought early occupancy and extra income for the New South Furniture Exposition, High Point, N. C.—wood furniture manufacturing center.

The Furniture Plaza, a display mart, had to be ready for the season's opening on October 21, 1960.

H. L. Coble, president of H. L. Coble Construction Company, the contractor, credits structural steel with making it possible to meet a tough completion schedule.

The steel frame for the six-story "showcase" was completed in exactly 30 days—faster than possible with any other material.

Here's what the contractor says this meant to the owners:

"$150,000—In additional rentals due to faster construction."

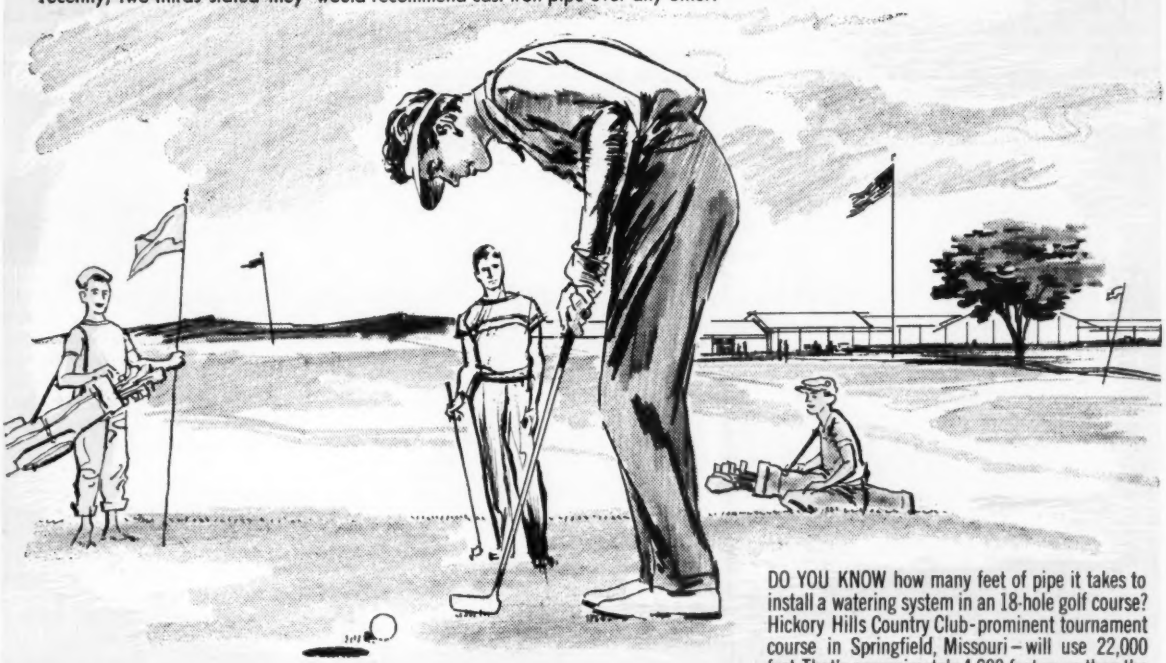
It pays to build in **STEEL**—
—for quicker completion and for earlier rentals.

American Institute of Steel Construction
101 Park Avenue, New York 17, N. Y.

Steel **STANDS** *for the future* AISC

PIPE FACTS

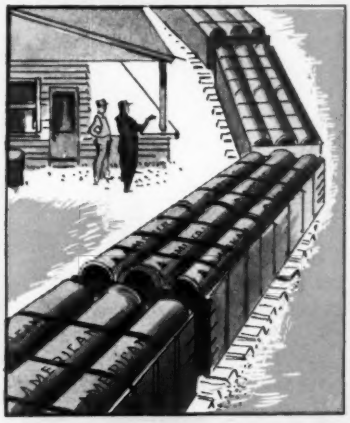
Consulting engineers prefer cast iron pipe! Of 430 consulting engineers surveyed recently, two-thirds stated they would recommend cast iron pipe over any other.



DO YOU KNOW how many feet of pipe it takes to install a watering system in an 18-hole golf course? Hickory Hills Country Club-prominent tournament course in Springfield, Missouri – will use 22,000 feet. That's approximately 4,000 feet more than the playing distance of this course! A large portion of this piping is 3", 4" and 6" AMERICAN Fastite pipe.

DO YOU KNOW that pipe must meet four definite tapping requirements? It must . . . (1) Be strong enough to withstand tapping operation. (2) Be of an easily-tapped material that assures uniform threads. (3) Be strong enough to withstand service conditions after tapping. (4) Have threads that insure leak-proof connections after exposure to service stresses. Cast iron pipe meets all four requirements!

DO YOU KNOW that a trainload of 11,000 feet of 36" AMERICAN cast iron pipe recently left Birmingham and arrived in Utica, New York . . . with only one pipe damaged? Such reports are not unusual and prove that cast iron pipe has the strength to withstand shocks and strains in transit . . . and also indicate the care AMERICAN exercises in banding and bracing pipe for shipment.



DO YOU KNOW that for river crossings and other difficult underwater installations, your best buy for permanence is AMERICAN Molox Ball Joint pipe? Here's why . . . (1) Pipe socket cast integrally with the pipe. (2) Heavy alloy steel follower gland for added strength. (3) High strength, corrosion resistant AMERICAN STAINLESS STEEL tee head bolts. It remains bottle-tight at any deflection; and changes in line and grade up to 15° can be made.

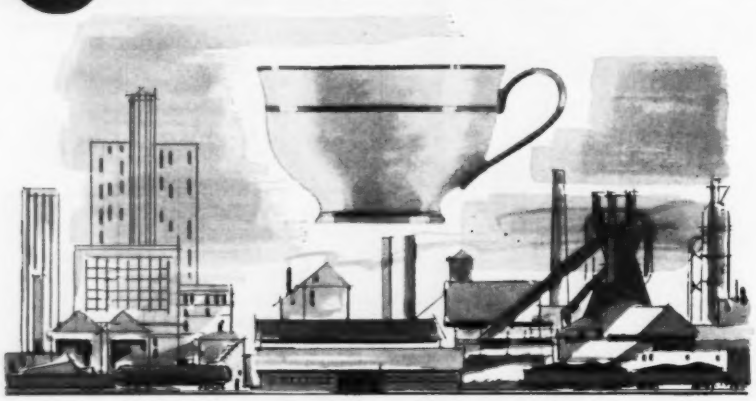
AMERICAN CAST IRON PIPE COMPANY
BIRMINGHAM ALABAMA

NEWS OF MEMBERS

Francis S. Friel, president of the Philadelphia consulting firm of Albright & Friel, Inc., on June 5 added another honorary degree to those he has already received from the Drexel Institute of Technology, Scranton University, Pennsylvania Military College and Lafayette College, when Villanova University conferred on him the degree of Doctor of Science. A Past President of the Society, Mr. Friel is presently vice president of the International Commission on Large Dams.

George C. Cooper, the new manager of reinforcing bar sales for the Cleveland District of the U.S. Steel Corporation, at the time of his appointment was sales engineer with the firm's Supply Division in Cleveland.

MH Roll-call for water



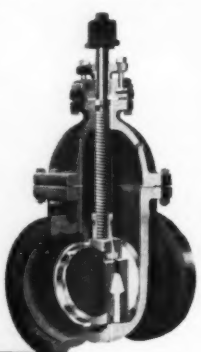
a CUP of WATER

Because until recently it always was available, a cup of water here has been considered a "little thing." Today, we suddenly realize that many water facilities are deficient . . . and a "cup of water" in some places no longer is a little thing!

Of the total population, 26.6 per cent or approximately 25 million citizens of the U.S.A., definitely have inadequate water supply.* In addition water supply is uncertain for 23.2 per cent of the population or nearly 21 million more. Only 50.2 per cent of the population, or approximately 45 million people, enjoy adequate water service. Of 587 water works systems, serving 25,000 population or more each, service is inadaquate or uncertain in 255 of them! The U.S. Department of Commerce estimates that water supply facilities within the next 20 years will need to be doubled.

Municipal and utility officials know this situation but in many cases need better public support before they can make a move. In future advertisements, we will attempt to sketch brief facts about the water shortage of particular groups of states.

*Survey by Water and Sewerage Industry and Utilities Division, Business and Defense Services Administration, U.S. Department of Commerce, Washington, D. C.



M&H VALVE AND FITTINGS COMPANY
ANNISTON, ALABAMA

Brother Amandus Leo, after 31 years as dean of the School of Engineering at Manhattan College (N.Y.), retires from that office at the end of the present academic year. He will, however, continue at Manhattan as a faculty member in the Department of Mathematics. Although he is retiring as dean, Brother Leo has just been re-elected president of the Association of Engineering Colleges of New York State for 1961-1962, having previously served the Association's 15-member institutions as secretary-treasurer for 11 years and as vice president for one year. In addition he is a member of Mayor Wagner's Advisory Planning Board for the Bronx (N.Y.) and has been its chairman since 1954.

S. Mark Davidson in the past 26 years has advanced from staff member in the engineering department of the Thompson Pipe & Steel Company to president and treasurer of the company. In the latter posts he succeeded **Walker R. Young,** who since his retirement four months ago has been retained as chairman of the board of directors.

J. Slater Davidson, Jr., a vice president and manager of the Charles H. Tompkins Company, continues in these capacities although the company has now become an operating division of the J. A. Jones Construction Company as its Washington, D.C., branch office. Also, **W. Orme Hiltabidle,** a retired Admiral of the U.S. Navy, will remain as a vice president of the Division. Long-time employees of the J. A. Jones Company, **Emil J. Kratt, Edwin L. Jones, Jr.,** and **Harold Kohler** will continue to serve, respectively, as vice chairman, president, and vice president and manager of the group's dam department.

Uel Stephens, after more than 18 years as director of the Fort Worth (Texas) Water Department, has retired from the Department. One of many outstanding projects constructed under his directorship is the new South Holly Water Treatment Plant, having a capacity of 50 million gal per day and costing in excess of $6 million. Mr. Stephens will continue to serve Texas' municipalities and industries through his Municipal Advisory Service offices at 307 Mutual Savings Building, 815 Throckmorton Street, Fort Worth.

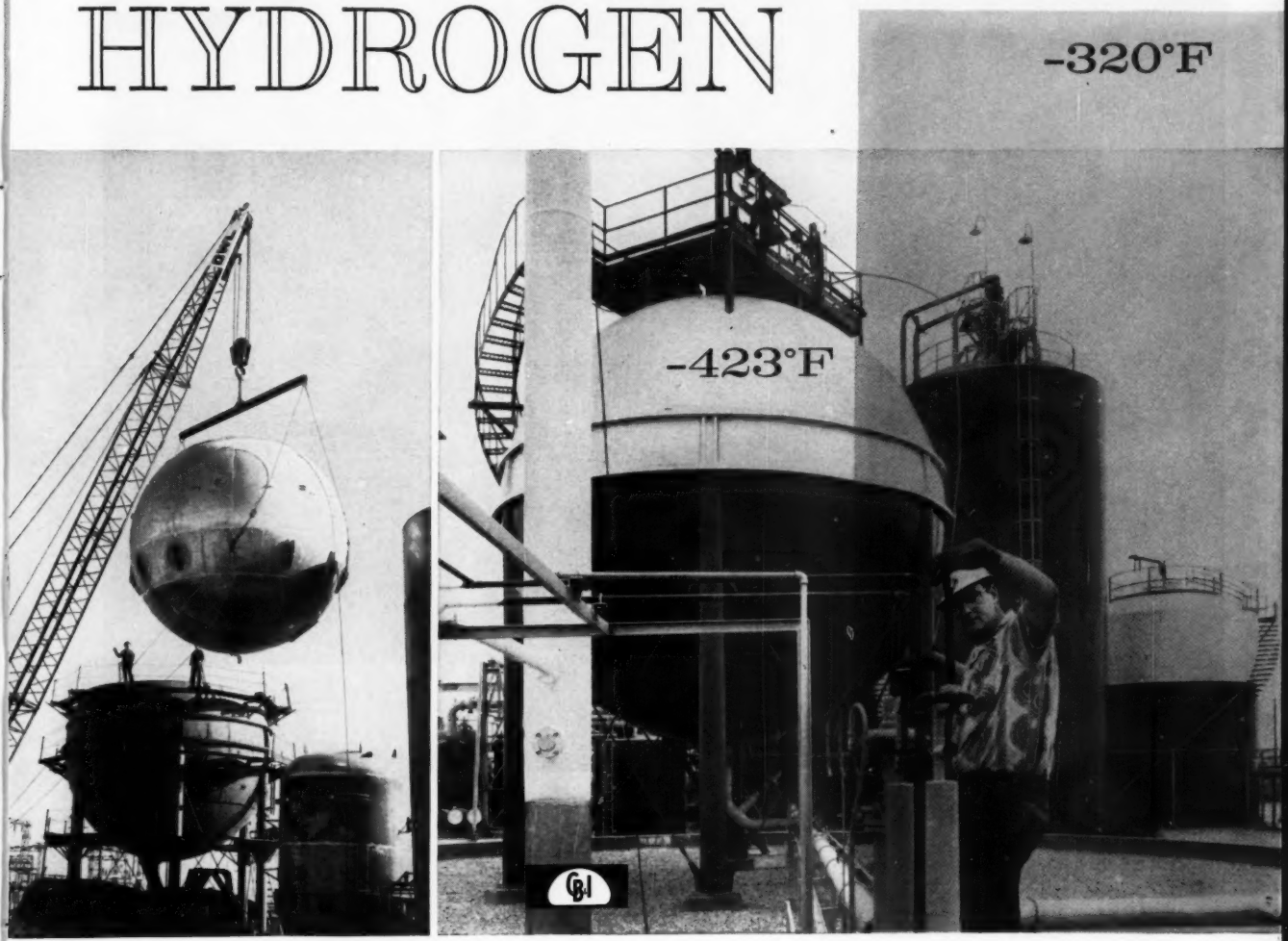
Walter C. Russell, who has served the American Cement Corporation and its predecessor companies since 1933, although retired as president and chief executive officer, will continue to serve

(Continued on page 21)

First privately owned and operated space-age plant furnishes liquid hydrogen to missile centers and industrial users

NITROGEN

HYDROGEN



These double-wall cryogenic storage tanks play a vital role in the first privately-owned plant to supply liquid hydrogen on a large-scale commercial basis. Hydrogen is stored in the sphere at –423°F and nitrogen in the cylindrical tank at –320°F. Located in Torrance, Calif. and owned by Linde Company, Division of Union Carbide Corporation, the plant will deliver 3,300,000 lbs. of liquid hydrogen yearly to missile centers. Both tanks were designed (using Linde-approved designs), fabricated and erected by CB&I, world's most experienced builder of cryogenic vessels.

ABOVE: Aluminum inner shells and carbon steel outer shells were used for the two cryogenic tanks. The spherical tank is 28 ft. in diameter and the cylindrical tank 21½ ft. Special insulation is between the shells.

TOP LEFT: The inner sphere is suspended in the outer sphere by stainless steel rods positioned around the perimeter. Resting on the ground nearby is the aluminum inner shell of the cylindrical nitrogen tank.

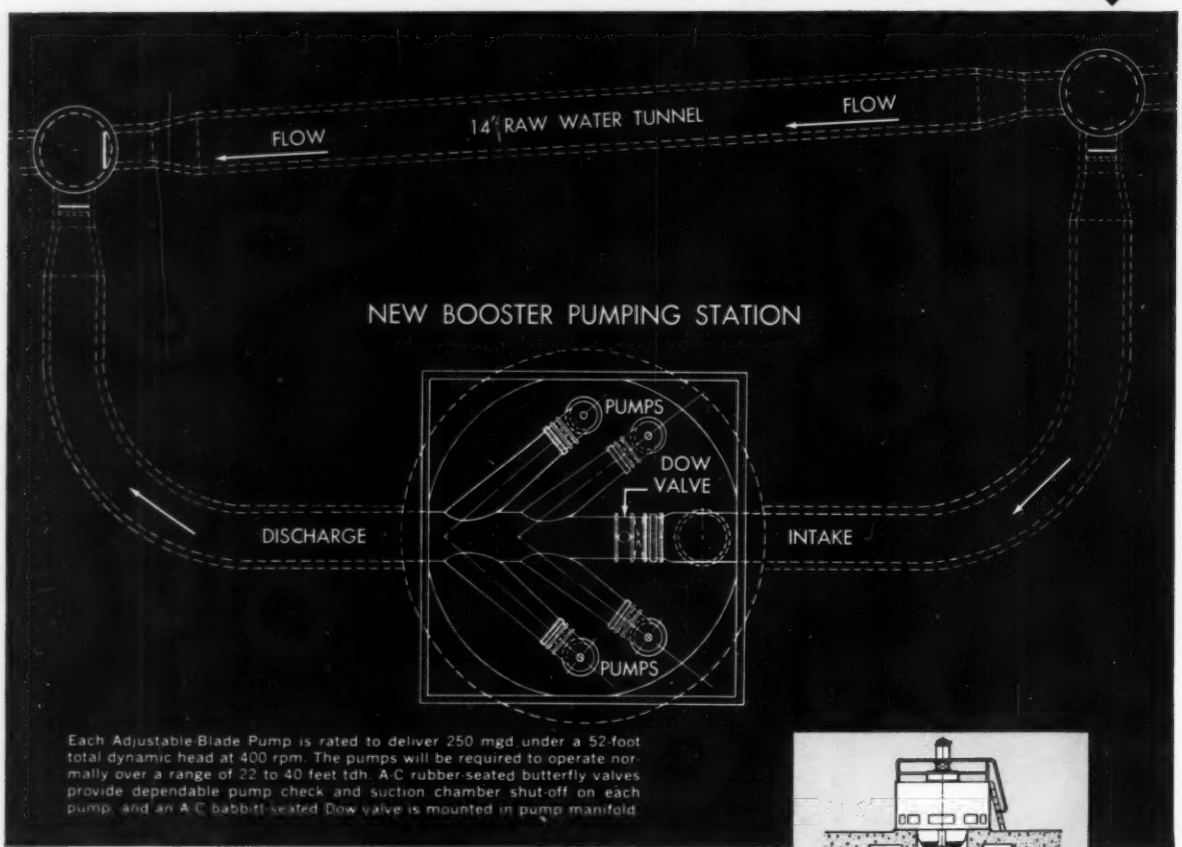
LEFT: A trailer is being loaded with liquid hydrogen for delivery to missile centers, other government installations, or industry.

CB&I

Chicago Bridge & Iron Company
332 South Michigan Ave., Chicago 4, Ill.
Offices and Subsidiaries Throughout the World

CB-612

ALLIS-CHALMERS



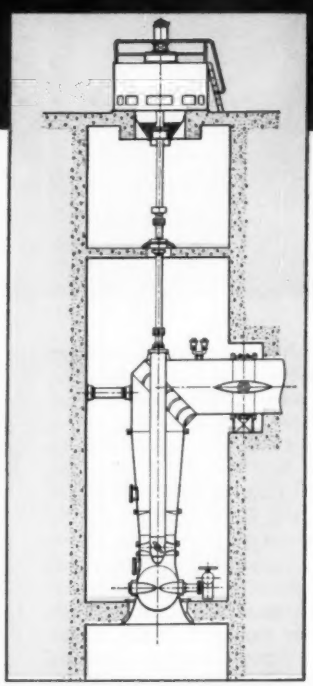
Each Adjustable-Blade Pump is rated to deliver 250 mgd under a 52-foot total dynamic head at 400 rpm. The pumps will be required to operate normally over a range of 22 to 40 feet tdh. A-C rubber-seated butterfly valves provide dependable pump check and suction chamber shut-off on each pump, and an A-C babbitt-seated Dow valve is mounted in pump manifold.

A-C Adjustable-Blade Pumps help City of Detroit augment raw water supply!

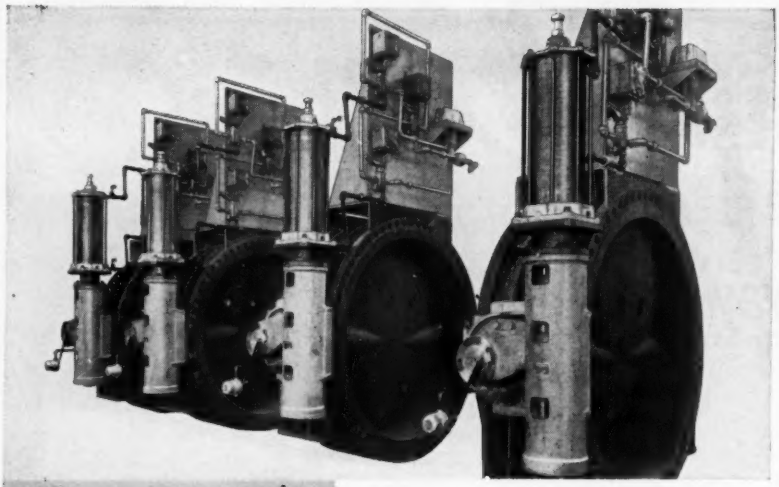
To augment the supply of raw water, Detroit, Michigan has installed four A-C Adjustable-Blade Pumps in a new booster pumping plant near the Detroit River. Pumps of this type were selected for their rapid, smooth response, under automatic control, to a wide range of flow demands.

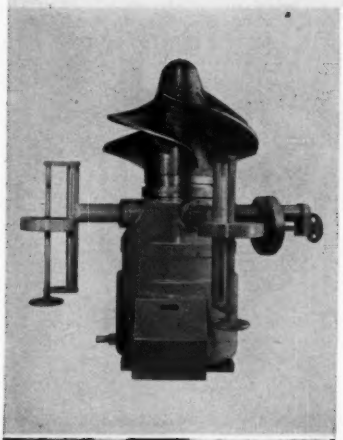
Adjustable-Blade Pumps will vary in output to meet the gradual changes in flow requirement as compared to stepped increments of flow and possible surges which would result if fixed-blade pumps had been installed.

Two of these pumps will operate when required to raise the hydraulic grade line and supply adequate raw water to two remotely located treatment stations. As demand increases, a third pump will be used. A fourth pump is available for standby service. Pump blade angles are controlled automatically by a positioner responsive to downstream hydraulic grade line. A-1488



You may obtain full information on A-C Adjustable and Fixed-Blade High Capacity Axial Flow Pumps and Valves by writing to Allis-Chalmers, Hydraulic Division, York, Pennsylvania.

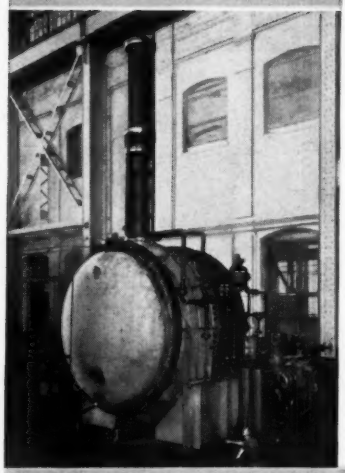




Four Allis-Chalmers 90-inch 50-16 fabricated steel butterfly valves used for pump check. These valves are equipped with the A-C full body rubber seat for dependable bubble-tight shut-off. Hydraulic cylinders, mounted on rugged crosshead mechanisms, provide smooth automatic operation.

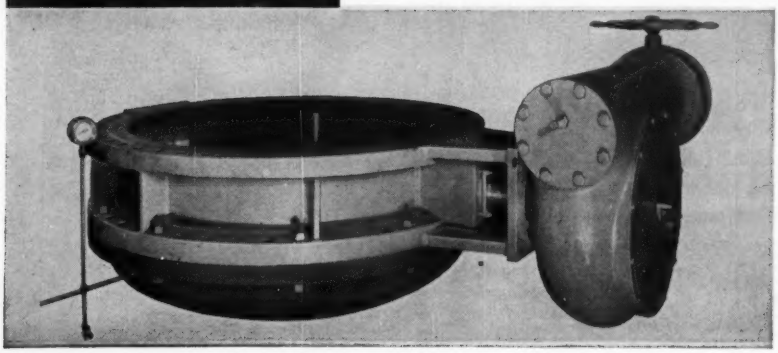
A-C adjustable-blade pump impellers are dynamically balanced after complete shop assembly and blade finishing.

ALLIS-CHALMERS



Allis-Chalmers 144-inch Dow valve with fabricated steel body and hydraulic operator provides tight closure in both directions. When valve is open, flow bypasses pumps or is diverted to pump sumps when valve is closed.

One of four A-C 72-inch AWWA Class 50-16 fabricated steel butterfly valves used on pump suction. These valves are equipped with the A-C full body rubber seat and A-C manual operator. This valve is shown being tested with 50 psi air under water to insure bubble-tight shut-off.



the company as vice chairman of the board of directors, as a member of the executive committee and as a consultant. Mr. Russell was succeeded as president and chief executive by **James P. Gifes.**

James Higgs, semi-retired, after many years with the Massey Concrete Products Company and later with the American-Marietta Company, is Atlanta representative of Queen City Railroad Construction, Inc., of Cincinnati. Mr. Higgs, a former ASCE Director, says the job gives him an opportunity to keep in contact with friends.

August R. Robinson of the Agricultural Research Service of the U.S. Department of Agriculture and the Colorado Agricultural Experiment Station at Fort Collins, conducted a display and demonstration at the U.S. pavilion during the Cairo International Agricultural Exhibition held March 25 to April 30. Part of the demonstration included a 120-ft irrigation structure designed by Mr. Robinson. In addition he took part in four seminars on water research and improved irrigation methods for the benefit of officials of the Ministry of Agriculture of the United Arab Republic.

Robert C. Baldwin is the new assistant editor of the *ACI Journal,* technical publication of the American Concrete Institute. Mr. Baldwin is a recent graduate of Kansas State University where he was editor of the student publication, the *Kansas State Engineer,* and president of the Student Chapter.

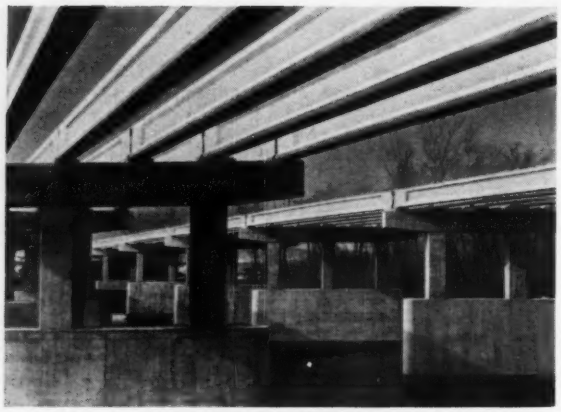
Thomas E. Stelson, appointed ALCOA professor of engineering by the Carnegie Institute of Technology, has been a member of the Carnegie faculty since 1952. From 1957 to 1959, Dr. Stelson was acting head of the department of civil engineering, and since the latter year, head. Recently returned from Pakistan where he served as a consultant to the Ministry of Education he was partly responsible for the formation of a Pakistan Society for Engineering Education.

Peter Corradi, a Rear Admiral in the U.S. Navy, was recently named by his alma mater, New York University, "Civil Engineer of 1961." Currently, deputy chief of the Navy's Bureau of Yards and Docks and deputy chief of civil engineers, Admiral Corradi served as commanding officer of the Construction Battalion Regiments at several South Pacific bases during World War II and, later, as district public works officer for the Sixth Naval District.

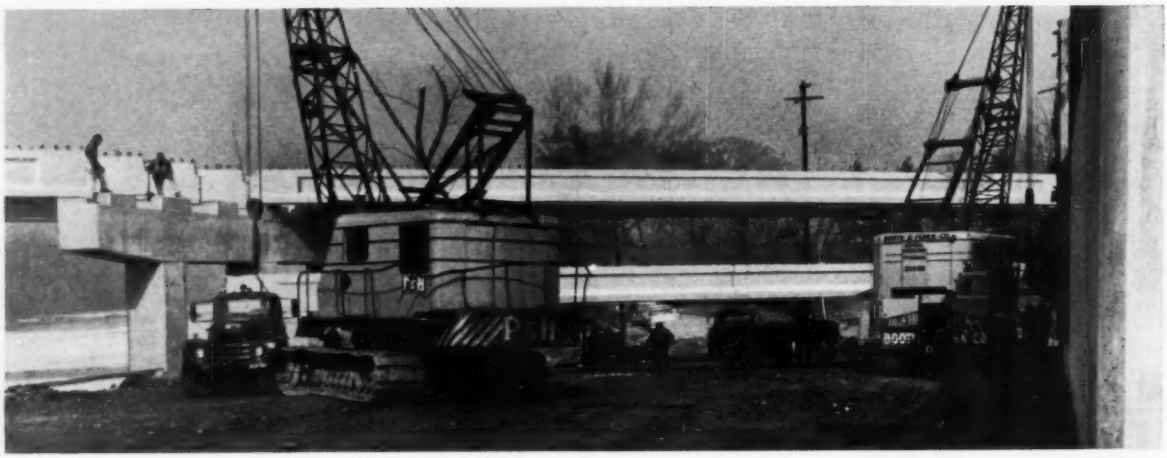
James E. Wolfe, the new district manager for Centriline Corporation, a subsidiary of Raymond International, will be located in the firm's newly established Los Angeles office at 816 West Fifth Street. His territory extends over seven western states, and includes many of the areas he previously serviced as general superintendent and production manager on pipe lining work in the West Coast area.

(Continued on page 24)

PRESTRESSED BEAMS *for Interstate Highway Twin Bridge*



Beams in place present graceful pattern of prestressed concrete. They range in length from 50′ 3″ to 90′.



Two cranes lift from truck and place this huge 41½ ton beam in a matter of minutes.

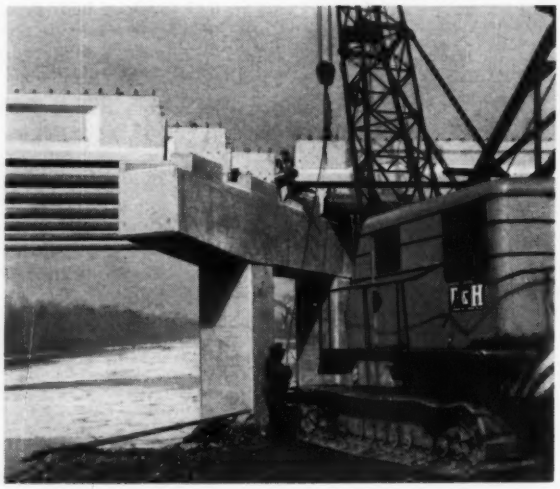
• At Neshaminy Creek, near Croydon, Pa., another link in the new Delaware Expressway between Trenton and Philadelphia is completed quickly through the use of prestressed concrete. There are 112 beams of varying sizes, the largest being 90′ long and weighing 41½ tons, in this 8-span twin bridge.

Like so many other bridges in this country's growing Interstate Highway System, this one is of prestressed concrete for experience-proved reasons: low initial costs, low maintenance costs, ease and speed of erection, trim appearance.

Eastern Prestressed Concrete Corporation used Lehigh Early Strength Cement in manufacturing the prestressed beams. Use of this cement permitted maximum production efficiency, resulted in quick completion of units to meet closely linked casting, trucking and erection schedules.

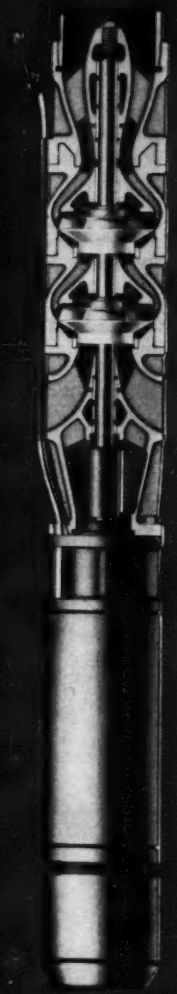
This is another example of the advantages of Lehigh Early Strength Cement in modern concrete construction. Lehigh Portland Cement Company, Allentown, Pa.

LEHIGH CEMENTS



Beams spanning stream are 45″ deep, while the 90′ beams spanning roadway are *only* 39″ deep.

Owner: Pennsylvania Department of Highways
General Contractor: Booth & Flinn Company, Pittsburgh, Pa.
Prestressed Beams: Eastern Prestressed Concrete Corporation, Line Lexington, Pa.



Regular Submersible

SUBMERSIBLE PUMPS

deliver water

economically

consistently

silently

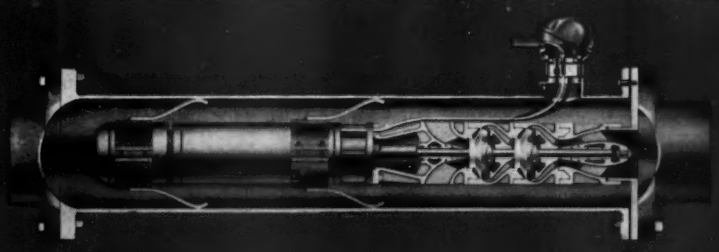
efficiently

The Layne Submersible Pump installation gives you noise free operation because the pump and motor are completely submerged. The Layne Submersible is adaptable to all wells; requires a minimum of space since no pump house is required; eliminates possibility of water contamination; and eliminates the opportunity for vandalism or other accidental mishap or damage.

Layne Submersible Pumps are available for wells as small as 6 inches and in capacities from 30 GPM up. For additional information write for free bulletin number 202.

The Layne In-Line Submersible pump provides the answer to many problems in booster pump applications. The pump operates as an integral part of the line and is designed for use by municipalities, industry, such as petroleum and chemical plants and by agriculture. Advantages include: simple installation, no additional space required, continuous service even under flood conditions, and no possibility of surface water contamination.

Layne In-Line pumps are made as small as 4 inch bowls on a 4 inch motor for use in a 6 inch pipe to deliver 30 GPM. Larger sizes are available as required. For additional information write for free bulletin number 203.



In-Line Submersible

Layne SINCE 1882 — COMPLETE WATER SERVICE

LAYNE & BOWLER, INC., MEMPHIS

General Offices and Factory, Memphis 8, Tenn.

LAYNE ASSOCIATE COMPANIES THROUGHOUT THE WORLD

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Find LAYNE Fast in the Yellow Pages under pumps

Fastest in 30 Yrs

Symons steel-ply forms provide record forming speed on big motel job

Ludwig Zahn, contractor on the new Holiday Inn, Mansfield, Ohio, reports the Symons Forming System provided faster pouring and stripping than any he has used during his 30 years in construction.

Particularly important was the king-stringer method which the contractor and the Symons engineering department devised to form the deck of the structure. King-stringers constructed of 2 x 4's bolted to 2 x 10's were 8 ft. on center. In between this were 4 x 4's supported by shores. Regular

View from "down under" showing stripping procedure. Note work space available with this type of slab system.

4-foot panels were then laid on the stringers and tied together with a Symons bolt and wedge in the center of each panel. To strip, they simply removed the 4 x 4 with its shoring and pulled down the panels. The stringer was left in position as support shoring for the required length of time.

For the *complete story, write us.* Symons forms are rented with purchase option.

Symons

SYMONS CLAMP & MFG. CO.

4295 Diversey Ave., Dept. G-1, Chicago 39, Ill.

Warehouses Thruout the U.S.A.

MORE **SAVINGS** FROM **SYMONS**

Robert P. Witt, new staff consultant to the Topographic Division of the U.S. Geological Survey for a one-year period, is on leave from Oklahoma State University where he is a professor of civil engineering. Mr. Witt in connection with his work as staff consultant will divide his time between the division's Washington, D.C., offices and touring area offices in Virginia, Missouri, Colorado, and California.

William Dean Frueh, formerly civil engineer in the construction department of the Iowa State Highway Commission, has become a partner in the engineering firm of Mann, Hager and Associates, of Council Bluffs, Iowa.

M. H. Cutler was recently named engineering manager of the Stone & Webster Engineering Corporation, of Boston, Mass., and New York, N.Y. Mr. Cutler has served as assistant engineering manager and chief structural engineer since joining the firm in 1923.

Earle B. Butler, Colonel in the Army Corps of Engineers, after several years as district engineer in Buffalo, N.Y., now heads the Military Construction Supply Agency, in Columbus, Ohio.

Martin W. Kehart, a retired Rear Admiral in the U.S. Navy Civil Engineer Corps, has joined the consulting engineering firm of Ole Singstad as a full time associate. His broad engineering experience includes 13 years on the design and construction of bridges and industrial buildings as a civilian, and 21 years on the design and construction of some of the Navy's largest projects.

Willis A. Jacus is president of the newly formed Alpha Engineering Company—a combine of six Minneapolis, Minn., engineering firms, representing specialization in each major branch of the profession—with offices at 350 Builders Exchange Building. In addition to Mr. Jacus, **Raymond E. Amble,** of Jacus & Amble, is secretary-treasurer, while **James A. Lindsey,** of the Lindsey Engineering Company, is a director.

Edward J. Costello, Jr., a Captain in the U.S. Naval Reserve, has just been named Rear Admiral. A veteran of over 25 years in the Reserve, he is now vice president of the Wiley Manufacturing Company of Port Deposit, Md. Admiral Costello served for several years during World War II in the Pacific Ocean area.

TESTlab NUCLEAR SOIL TESTING SYSTEM

NEW PORTABLE ACCURATE LOW COST SAFE

Permits a complete moisture and density test in less than 5 minutes. TESTlab system incorporated improved portable scaler and is half as heavy as other systems. Densities by direct transmission.

Applicable to following fields:

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Surface Moisture Gage and Scaler. System illustrated weighs 34 lbs.

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Represented in Canada and most foreign countries.

Write, phone or wire for information or appointment for demonstration

12 page illustrated brochure completely describing our Nuclear systems, VoluTESTer and related equipment available upon request.

Holbert W. Fear, following his retirement from the U.S. Geological Survey after 26 years (See CIVIL ENGINEERING, October 1960, page 27), recently received the Meritorious Service Award of the U.S. Department of the Interior. The citation commends Mr. Fear for his success in recruiting professional personnel and for his outstanding efforts in the field of public relations. As assistant district engineer in Albany, N.Y., Mr. Fear shared in planning the hydraulic engineering investigations throughout New York State which included an enlarged program for the collection of basic data on surface water resources.

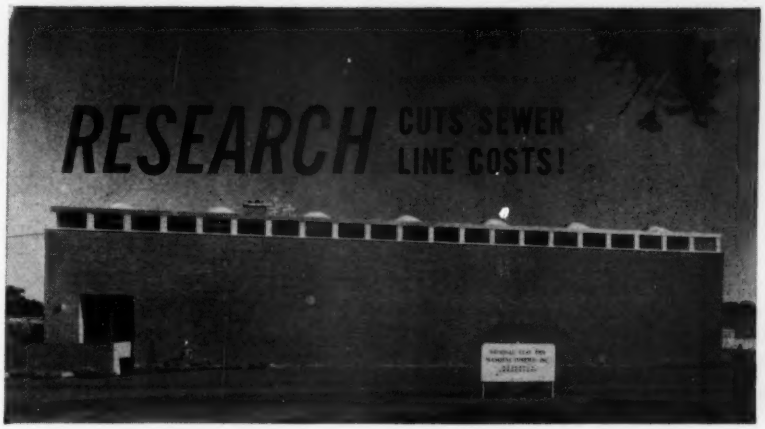
Carl A. Trexel, formerly Rear Admiral in the U. S. Navy Bureau of Yards and Docks, retires as vice president of the Tudor Engineering Company on July 1. Thereafter, his address will be 40 Winston Drive, San Francisco 27, Calif.

Albert Edward Simmons recently culminated several years of graduate study and research at the University of California's Institute of Transportation and Traffic Engineering when he received his Doctor of Engineering degree. Currently, assistant district engineer in the California State Division of Highways, Dr. Simmons has designed and developed a highway lighting visibility meter that provides an objective appraisal of visibility, referenced to a standardized objective contrast.

Charles P. Weisz assumed new duties as structural engineer for the Wire Reinforcement Institute in May. For the past nine years he has been in charge of plan preparation for Hazelet & Erdal in Cincinnati, Ohio, supervising design for bridges, highways, sewers, railroads, industrial buildings, and other major projects. His new post was created in answer to rising interest among engineers and consultants for assistance in arriving at designs effectively employing welded wire fabric.

Earle V. Miller, a partner in the Phoenix, Ariz., firm of Johannessen & Girand, retired last April 30. For 40 years Mr. Miller has devoted himself to improving Arizona's highways and many of the modern concepts of Arizona highways can be traced to his efforts.

Lee T. Purcell, consulting engineer with offices in Paterson, N.J., was elected president of the five-member New Jersey State Board of Professional Engineers and Land Surveyors recently. Recognized as an expert in the field of water supply and sanitation, for several years past he has been retained as a consulting engineer by the State as well as by many municipalities in the State, including, at present, the preparation of plans and specifications of the $45 million Round Valley Water Supply Project for the North Jersey District Water Supply Commission.



The Clay Pipe Industry's research has pioneered dramatic new developments, making production and installation of lifetime Vitrified Clay Pipe more efficient and effective.

For example, Clay Pipe Industry research discovered the revolutionary resilient compression joints which are now offering important savings in installation time and cost to users of lifetime Vitrified Clay Pipe sanitary sewers.

Other important tests are now going on at the Crystal Lake facility, by contract at colleges and universities all over the country, and at the modern laboratories maintained by individual Clay Pipe manufacturers.

One experiment that promises to have far-reaching effects: detailed, year-long observations of root penetration of 16 separate sewer pipe joints. Others include shear load studies of both pipe material and joints, development of new, less expensive jointing materials and techniques, exhaustive analyses of competitive products, flow-coefficient studies, and various tests aimed at improving the clay pipe itself.

Results of the most significant of these tests will be announced as they become available.

Under the direction of A. J. Reed, NCPMI Vice President and Director of Research, new breakthroughs in manufacturing and uses of Clay Pipe are being made, offering greater, more confident service to those who specify and use lifetime Vitrified Clay Pipe..

NATIONAL CLAY PIPE MANUFACTURERS, INC.
914 20th Street, N. W.
Washington, D. C.

Please send me full details on the new factory-made compression joints on Clay Pipe.

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(company)

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COMPRESSION SEALED, VITRIFIED
CLAY PIPE
IMPERVIOUS
THE STANDARD in SANITARY SEWERS

NATIONAL CLAY PIPE MANUFACTURERS, INC.
Washington, D. C.

Steel fabricator helps customer reduce steel requirement 14% with A36 Structurals

Architect: Donald E. Stoll, A.I.A., (left) and Robert G. Graham, Jr., design engineer for McMurray Structural Steel Co., both of Nashville, Tenn.

These new 16-inch, wide-flange lightweight sections at 31 lbs. in A36 Steel were used in lieu of the 16-inch, wide-flange sections at 36 lbs. necessary in A7 Steel.

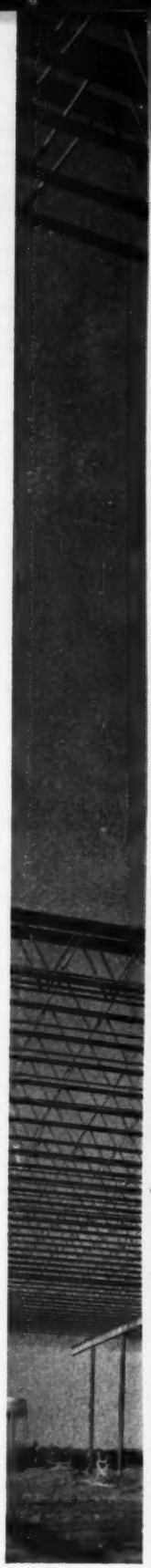
"Dominion Electric Corporation's new manufacturing plant in Gallatin, Tennessee represents the Southeast's first combination of the advantages of A36 steel, lightweight sectional structure, and the plastic method of design," says Mr. Donald E. Stoll, architect for the project. "Plastic design makes the total steel area one of working strength."

Mr. Robert G. Graham, Jr., design engineer at McMurray Structural Steel Company, Inc., fabricators of all the steel for the plant, said, "Specifying A36 Steel for our beams reduced our structural steel requirements by six tons and cut approximately $1,500 from our costs. Structural steel in this project consists of 36 tons of beams and 10 tons of structural grade pipe, used as columns. In addition, there are 85 tons of bar joist purlins made of A7 Steel. These were not available in A36 at the time we started work, but if they had been, they would have saved us even more. We used 36 tons of A36 beams and we would have needed 42 tons of A7 for the job—a saving of 14% on the beams."

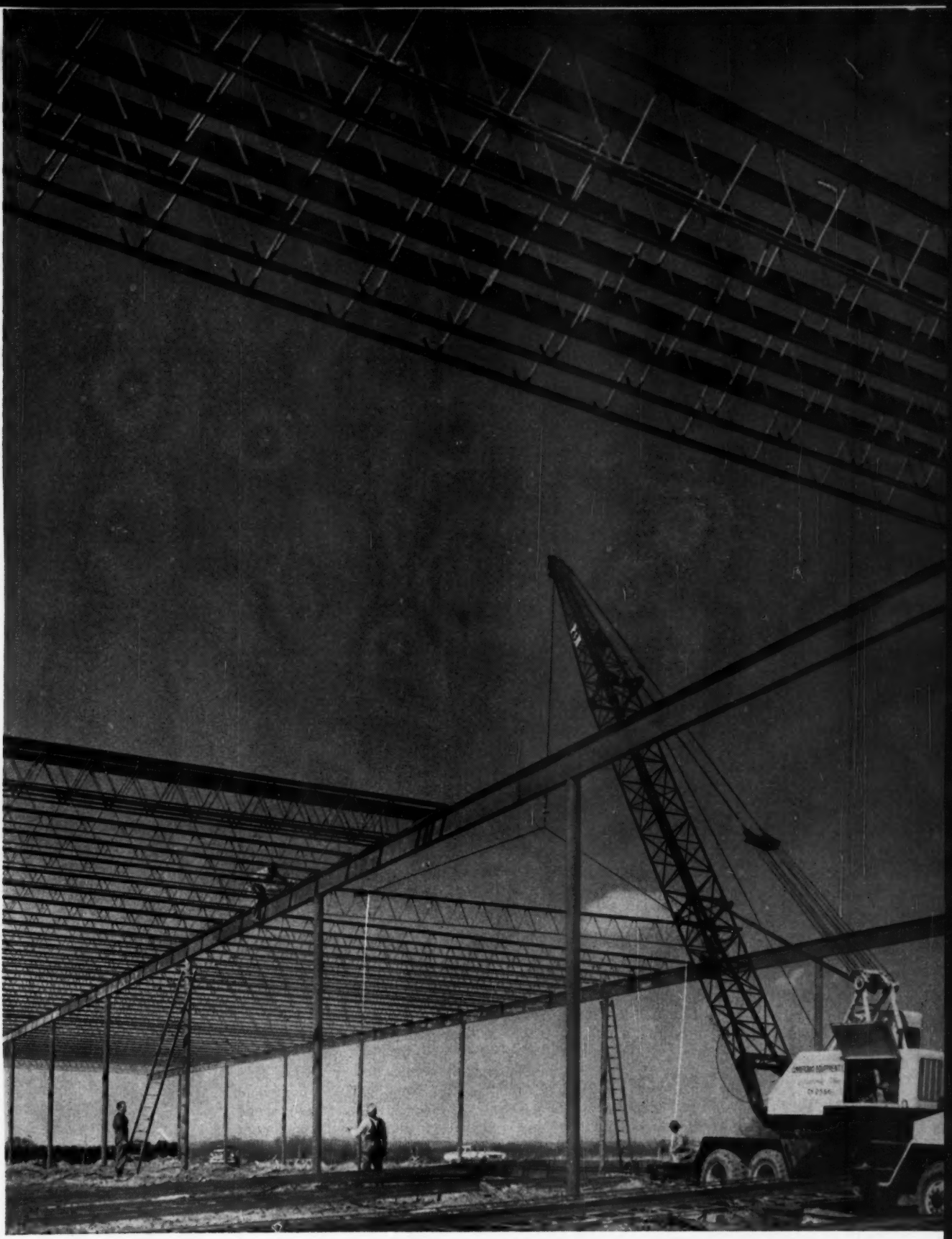
All the steel, including the new weight-saving structural shapes recently introduced, was supplied by the Tennessee Coal & Iron Division, United States Steel. A36 Steel with its higher yield point of 36,000 psi, costs very little more than A7 Steel.

The plastic concept of design, so important on this project, is based on the ultimate load capacity rather than on initial yielding. Mr. Stoll said, "It is being used extensively where sound, economical steel design is the objective." Mr. Graham also estimated that the plastic concept resulted in a *50% saving of design time* on this project. For more information, write United States Steel, 525 William Penn Place, Pittsburgh 30, Pa. USS is a registered trademark.

United States Steel Corporation • Columbia-Geneva Steel Division • National Tube Division • Tennessee Coal & Iron Division • United States Steel Supply Division • United States Steel Export Company

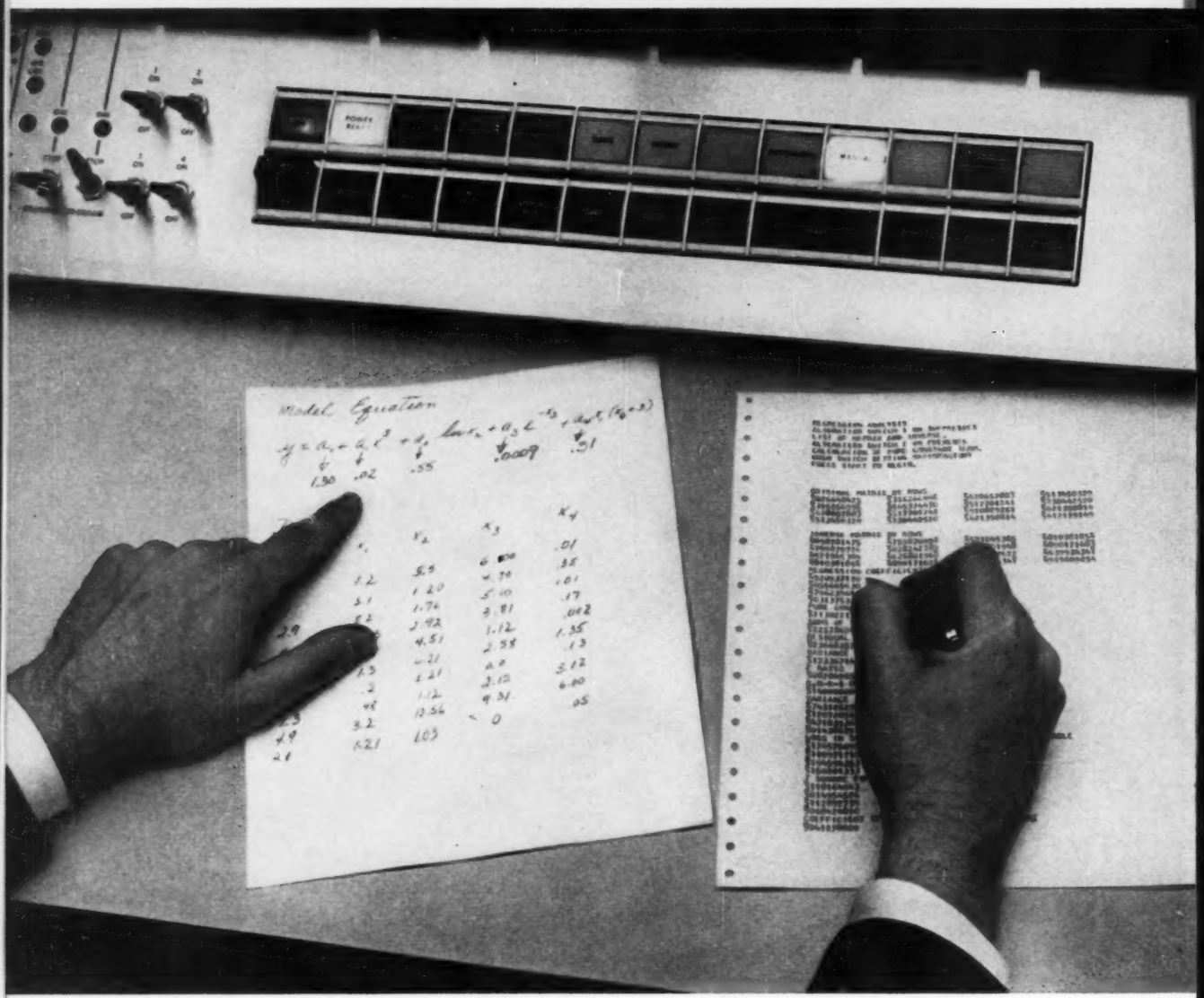


USS **United States Steel**



New plant of Dominion Electric Corporation, Gallatin, Tennessee, under construction by General Builders Corporation, Nashville, Tennessee. Higher strength USS A36 Steel Beams saved 6 tons of steel. Note simplicity of design.

This mark tells you a product is made of modern, dependable Steel.



Want to find the coefficients? It's easy with the new Regression Analysis program for the IBM 1620

Here's another program offered free-of-charge to users of the IBM 1620 Data Processing System. It gives you the kind of results you might expect only from a much more expensive computer. But users of the 1620 know that its low rental cost is deceptive. The 1620 packs *more computing power per cubic inch* than any other computer in its size range.

The Regression Analysis program is a good example. Suppose you want a fit for production purposes. If you employ more than two variables you probably have difficulty visualizing the representation of your data. If linearity is not the case, you must often guess blindly at a polynomial of high degree, accept or reject the fit with something approaching a sixth sense, and either try again or settle for the results you have.

The new Regression Analysis program lets you handle expressions containing up to *24 variables*. If you have the even more complicated task of handling many dependent variables, the program will generate regression coefficients with a maximum number of dependent variables not exceeding one-half the number of independent variables.

This program will also fit non-linear functions and hyper-surfaces. Compare this performance with that of any other computer in the 1620's price range.

A basic 1620 installation rents for just $1600 per month. For details, contact your local IBM Representative.

IBM's 1620 is a compact desk-size computer.

IBM®
DATA PROCESSING

. . . . . *Am-Soc Briefs*

▶▶ Concerning civil engineering curricula. . . . A majority of the nation's engineering educators favor sweeping changes in engineering curricula—including a pre-engineering program and extending the period of education. The opinion of the educators was obtained in a mail ballot conducted by ASCE as an outgrowth of the 1960 Conference on Civil Engineering Education, held at the University of Michigan. An analysis of the ballots—made by the ASCE Committee on Engineering Education with the help of a special advisory group from agencies concerned with engineering education—appears on page 43.

▶▶ Attention, pipeliners. . . . The Pipeline Division's Committee on Pipeline Planning is alerting pipeline engineers to be on the lookout for a questionnaire they will soon receive from a Task Force of the Committee charged with investigating the economic aspects of reducing pipeline corrosion. Though filling out long questionnaires can be pretty time consuming, the Task Force does need to have preliminary data on practices in the water, oil, gas, and products pipeline industries before it can accomplish its objective. So give the questionnaire top priority.

▶▶ The print order for the five parts of the 1961 ASCE TRANSACTIONS is about to be given. If you have not placed your order, do so now!! If you have misplaced the material that was mailed in May, just drop a note to ASCE for a replacement.

▶▶ On the UEC front. . . . The Mining Engineers and the Electricals have now joined ASCE in completing their allotted share in the drive for funds for the new United Engineering Center. With the Mechanicals within easy reach of their goal, things are looking up for the original Founder Societies. Remember, one of the big features of the Annual Convention, set for New York this October, will be the UEC Open House on October 19. Tentative plans also call for the formal dedication of the new Society Headquarters to be some time in October.

▶▶ The Engineering Societies Library has a real problem—how to move 6 miles of books, or 180,000 volumes, from West 39th Street to its new home in the United Engineering Center on United Nations Plaza (345 East 47th Street, New York 17) without disappointing its many clients. The big move will start soon after completion of the building, scheduled for August 1, and will take about three weeks. During this period the Reading Room will be closed and telephone service curtailed. However, the Library expects to keep on answering, though probably with some understandable delays, all mail requests for general engineering information and for the usual Library services—literature searches, translations, and microfilming and photocopying from publications in the Library. . . . By Labor Day or soon afterwards the Library expects to be in full service as usual.

Republic Savings and Loan Association Building, Dallas, Texas. Architects: Fisher & Jarvis, AIA, Dallas. Engineer: Edward L. Wilson, Dallas

Cited for design excellence by the Texas Society of Architects . . .

modern concrete building blends spectacular beauty with practical economies

Selected as an outstanding example of contemporary Texas architecture, the new Republic Savings and Loan Association Building was chosen for exhibition during the State Fair of Texas.

Among many interesting features, the 4-story structure with lower-level parking is distinguished for its graceful honeycomb cast concrete solar screen. It shields the massive southern exposure against peak solar heat loads—yet admits plenty of daylight. Its design reduced air-conditioning requirements by 10 tons, saving $6,000 in equipment plus continuing savings in operating costs.

Fashioned with white portland cement, the lacy solar screen provides a pleasing contrast with adjacent precast concrete panels of brown and cork-colored marble aggregates. Even the concrete terrace steps and floors add decorative interest with their exposed aggregate surfaces.

Structural strength, fire-safe qualities and construction economies were important factors in the choice of concrete for this building. Time, labor and money were saved with the multiple use of forms in the building of concrete frames and pan joist floors. And because of concrete's ready availability, there was no time lost in scheduling.

From every point of view – construction efficiency, beauty, durability and low maintenance costs—modern concrete delivers more for the money!

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do you know that

Two Associate Members of ASCE are among the first volunteers chosen for the Peace Corps? Congratulations to Peter W. von Christierson, of Fair Oaks, Calif., now a graduate student in engineering at the University of North Carolina, and Arthur Young, of Schwenksville, Pa., now employed by the U. S. Forest Service at Missoula, Mont. as a highway engineer. The two young men are in a select group of 27 chosen from among 4,000 applicants who recently took a five-hour examination. Two other civil engineers were also in the group selected. First assignments will be on a village development project in Colombia and road building work in Tanganyika.

■ ■ ■

Smoke-abatement laws date from thirteenth century England? Violators of a law, enacted in 1273 and aimed at silversmiths who made unwise use of soft coal, were executed. This drastic method of enforcement was reported at the recent fifty-fourth annual meeting of the Air Pollution Control Association, held in New York City. It was the consensus of papers read that sharp increases in deaths from pneumonia and other lung diseases, in the metropolitan area in the past decade, are directly attributable to air pollution.

■ ■ ■

More than half the 41,000 "engineers and scientists" employed by state governments are civil engineers? Of these, 93 percent are employed on highway and public works projects. In a recently completed survey of the technical personnel employment picture in state government, the National Science Foundation found that only 56 percent of the engineers in highway departments have bachelor or higher degrees but that 88 percent of the engineers employed by health and welfare agencies hold degrees.

■ ■ ■

1960 was a grim year in the contracting field? The number of failures—2,607—was even worse than totals reached during the depression. Failures in large concerns (over $100,000) increased most alarmingly of all—up 67 percent from 1959. Total failures among all construction contractors were up 26 percent from the previous year. Especially hard hit were contractors in the Midwest and Far West. Figures are from the June issue of *Rock Products,* quoting Dun & Bradstreet.

■ ■ ■

California is having its worst drought since 1931? Department of Water Resources reports indicate that 1961 is stacking up as the third consecutive dry year and the worst of the three. On the basis of records going back to 1900, the current three-year period challenges the 1929-1931 period as the driest three years. The statewide forecast is that water supply will be 65 percent of normal.

This continent's newest railroad is nearing completion in Mexico? The 570-mile line, called the Chihuahua and Pacific Railroad, will run southwest from Ojinaga, Mexico (across the Rio Grande from Presidio, Tex.) to Topolobampo, on the Gulf of Mexico. In addition to opening one of the hemisphere's most scenic regions to tourists, the line will shorten travel distance between the Midwest and Mexico's Pacific Coast.

■ ■ ■

U. S. motor-vehicle registrations totaled 73,895,274 in 1960? According to Federal Highway Administrator Rex Whitton, this represented a gain of 2.4 million vehicles over 1959 registrations. California, with 7.8 million vehicles, had the highest number of registrations, and New York was second with 5.1 million. Next were Texas, Pennsylvania, and Ohio, with over 4 million registrations each. On the other hand, Delaware, Nevada, Vermont, and Alaska each had less than 200,000 vehicles.

■ ■ ■

More accurate earthquake recordings are in the offing? New instruments are being supplied by the U. S. (through the Coast and Geodetic Survey) to 125 recording stations all over the world. They are expected to provide uniform quantitative data for study of earthquakes, earthquake mechanisms, seismic wave propagation, and energy determinations. The information will be fed back to the Coast and Geodetic Survey for evaluation.

■ ■ ■

The outlook for June engineering graduates is good? In fact, it is even better than last year, on the basis of a recent survey of large manufacturing firms made by the National Industrial Conference Board. Last year the 210 companies hired 6,906 engineering graduates; this year they will hire 7,326. This is in sharp contrast to a decline in the number of non-engineering graduates to be hired this year. What's more, engineers will also receive better salaries. The salary range is from $439 per month for business trainees to $520 for engineers (with above-average records).

■ ■ ■

The Sudan will build a big dam on the Blue Nile? Giving impetus to the Roseires Dam project are two recently announced international bank loans of $32,500,000. The West German government will also contribute a $19,000,000 long-term loan. To be built on the Blue Nile 66 miles downstream from the Ethiopian border, the dam will irrigate almost 900,000 acres. The concrete central section—196 ft high and more than 3,600 ft long—will be flanked by earthfill embankments, giving the dam an overall length of about ten miles. The reservoir will store over 2,200,000 acre-ft. Construction time will be about seven years.

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Pier 40 Superstructure (Holland-America Line). Owner: City of New York, Department of Marine and Aviation; Architects and Engineers: Roberts & Schaefer Co., Inc.; General Contractor: Corbetta Construction Co., Inc. (all of New York).

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Construction of the superstructure on Manhattan's precedent-setting, 15-acre Pier 40 represented a major coordination feat for the contractor. More than 12,000 precast members and prestressed members in hundreds of shapes and sizes were produced on precise schedules—nearly all cast at the site. Again, Incor 24-hour cement proved its worth. Used exclusively for the cast-in-place concrete as well as the precast units, it enabled the contractor to accomplish the job on schedule, and with a considerable saving in forms.

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PARKING GARAGES . . . good design for good parking

MERRITT A. NEALE, F. ASCE, Executive Director, Public Parking Authority of Pittsburgh, Pittsburgh, Pa.

A parking structure should be functional, and no attempt should be made to conceal its purposes. Some early designers tried to give these structures the appearance of office buildings. Unfortunately, motorists searching for a place to park did not recognize these structures as garages until they had passed them. In other instances the architectural embellishments discouraged prospective parkers, who felt that the rates must be excessive to cover the cost of these frills. Yet the writer believes that such structures should be pleasing to the eye. They should be designed to harmonize with the neighborhoods in which they are located and even to upgrade them.

The most important element in good design of parking structures is service to the customer. Basically a garage patron would like to park next door to his destination and spend a minimum of time in parking and "unparking" his car. Experience has shown that customers' criticisms may range from too narrow inter-floor ramps or parking stalls to poorly located service facilities, such as elevators, cashier and waiting areas.

Another factor in good parking garage design involves the development of a sound and flexible functional plan. Let us assume for the moment, that a comprehensive parking survey has determined a strategic location for a proposed structure. In addition, the type of demand (shoppers, employees, theater goers, etc.) to be served has been ascertained as well as the parking-time characteristics of each group. With this information in hand, the designer's first step should be to prepare a schematic layout of the facility taking into account the size, shape and topography of the site as well as its relationship to the street pattern.

The Pittsburgh Parking Authority's seven-level Forbes Avenue Garage was built on a downtown site approximately 220 ft square. Several alternate schemes were studied, but the one finally adopted was dictated entirely by the dimensions and topography of the site. In fact, the final plan resulted in a 71-degree parking layout with separate circular ramps for up and down inter-floor movement. The location of entrances and exits was carefully analyzed in view of one-way traffic movement on all four streets bounding the project. Such preliminary studies should be made by, preferably, a firm experienced in the planning and design of parking facilities.

If an owner or developer has determined at an early date who will operate a proposed parking facility, it can be extremely advantageous, at this point, to invite the ideas and suggestions of the prospective operator. The designer, for instance, may think he has planned an easy turning movement at the end of a line of parking stalls, as shown on his drawing. An experienced operator usually can tell at a glance how simple or difficult this maneuver actually will be in practice for the average driver.

The optimum capacity must of course be determined and just how well this is done directly affects the operating cost. Experience with multi-floor parking structures has shown the necessity of synchronizing both the capacity and the design with the market to be served. Naturally, a low operating cost allows management some flexibility in adjusting the rate structure to attract the most practicable and profitable balance of transient and monthly parkers. The decision on optimum capacity should take into account the street capacity as well as the ability of the structure to receive and discharge cars during peak periods.

If the capacity per floor is large, the number of floors should be few. If the area per floor is small and the land value high, which is generally the case at downtown sites, then vertical stacking of floors may be justified. It should be noted that it costs more to operate a multi-story structure than a surface lot of the same capacity. Ramp-type structures are generally built to a maximum of about six levels above grade. Higher structures are more costly to operate and service standards are greatly reduced. In the case of sloping floor facilities, the distance and time required for a customer to drive up more than six levels establish this as the practicable height limit for this type of structure.

The parking angle

The typical parking angle established will have a direct bearing on column spacing, bay width, parking module and type of aisle and inter-floor ramp system. Five of the Parking Authority's seven self-parking garages have a 90-deg parking angle, one has a 71-deg angle, and the latest has a 60-deg angle. All the garages with a 90-deg angle have two-way traffic in the aisles. In these facilities, an attempt has been made to achieve a standard unit parking depth (car length plus aisle width plus car length) of 60 ft. If the typical car length is established at 18 ft, the aisle width would be 24 ft, a width necessary to give sufficient maneuvering space to swing into the 90-deg stalls. Two-way traffic in the aisles does not impede flow in and out of the garage and is not conducive to accidents, since persons parking their own cars generally drive and park quite carefully while in a garage.

The writer is convinced that the woman shopper prefers parking at an angle of less than 90 deg for reasons of convenience and ease of parking. In the Authority's garages with a 90-deg parking angle, it has been observed that most women prefer to head into

the parking space while men prefer to back in. The Forbes Avenue Garage, with its 71-deg parking angle, is directly across the street from a large department store, the main parking generator in the area. The Allies Garage, located two short blocks farther away, is a sloping-floor structure with 90-deg stalls. Most of the women shoppers destined for the department store prefer to park in the Forbes Avenue Garage for two reasons: (1) it is closer to the store, and (2) it has a 71-deg parking angle. Generally speaking, all parkers, both men and women, will put up with a number of inconveniences in order to get a location close to their destination.

The sites for the two newest garages developed by the Pittsburgh Parking Authority were analyzed, before final design proceeded, with 90-deg and 60-deg layouts. In the case of one facility, the final decision was to adopt the 90-deg scheme because, in that area of the downtown district, long-time parkers predominate, thus making the larger capacity of the facility more important than the greater maneuverability obtained with 60-deg parking. The other garage, because of its location in an area of short-term, high-turnover parking, was finally designed with a 60-deg angle because there the loss in capacity would be compensated for by increased maneuverability and operating efficiency.

The final decision between 90-deg and approximately 60-deg parking will be a matter of judiciously balancing the following factors: (1) number of short-time versus long-time parkers; (2) space count of 90-deg versus 60-deg parking, and (3) type of parker expected, that is, man or woman and shopper or business person.

Design factors

Unless there is a sudden large increase in the number of smaller automobiles, it would not be economically feasible to provide a substantial number of spaces in a particular facility to handle only the compact-type car. It is doubtful whether the majority of economy-minded small-car drivers would be willing to park on an upper floor where the parking rate might be considerably less for the smaller cars. While a lower rate might be justified for these less desirable spaces, the chances are that they will be just as much in demand by the driver of any car, regardless of size, particularly if the garage is in a "hot-spot" location.

One of the first problems confronting the garage designer is the choice of the type of construction after an evaluation of the advantages and disadvantages of various alternates. Of course, his choice will be restricted if a local building code does not permit, for example, the use of exposed structural steel. If no such code exists then both fireproofed structural steel and reinforced concrete frames should be considered for each site. Pittsburgh permits exposed structural steel frames in parking garages under certain conditions but the interior columns must be fireproofed. The perimeter columns and the beam and girder system can remain uncovered.

In 1954, when the first garage of this type was built in Pittsburgh, the cost of steel was such that a steel-framed structure was cheaper than one of reinforced concrete. However, a steel frame must be painted every few years while reinforced concrete requires little if any maintenance. Also, the insurance rate on exposed steel structures is a bit higher than that on reinforced concrete. For this location, estimates showed that neither the increased cost of maintenance nor the increased insurance offset the difference in capital cost over a period of 30 years.

Concrete versus steel

In 1957, an analysis made by the Parking Authority for another garage showed that reinforced concrete would be more economical than exposed steel. At this location a cantilevered, reinforced-concrete design was primarily responsible for reducing the cost below the standard steel design in which columns would have been located on the property line. Because of such conditions, the choice between a structural steel and a reinforced concrete structure is not always clear cut.

The floor system of the 500-car exposed-steel garage just mentioned was designed for a live load of 50 psf on all floors except the roof, where a load of 70 psf was used. This liberalized liveload requirement resulted from an amendment to the Pittsburgh Building Code following extensive study of open-deck parking garages in numerous cities throughout the country. Also, the amended code permitted the use of exposed steel framing, eliminated sprinkler systems except for underground garages, permitted the use of open metal-type railing instead of solid concrete parapets, and approved of counting an unenclosed ramp as a pedestrian exit. As for the reduced live load, it is the writer's judgment that 50 psf not only is adequate but is far more realistic than the former 75 psf required for the design of a parking garage intended to serve passenger vehicles only.

Excluding architectural, engineering and other related costs, the steel framed garage was built at a cost of $1,543 per car space, or $4.79 per sq ft. In spite of the comparative economy in first cost of this design, operating experience has shown that the steel frame is not dissipating the dynamic forces and vibrational effects caused by the constant movement of vehicles. Undoubtedly this deficiency could have been overcome by using heavier and more rigid beam and girder sections.

Roof problem solved—almost

Another design problem of the garage under discussion involves the roof parking area. With two dissimilar materials used in the construction of this facility, it is easy to understand the adverse affect that severe weather and temperature changes have on the roof deck. Although membrane waterproofing was placed over the entire roof and topped with a bituminous wearing surface, numerous cracks have developed in the structural slabs in spite of the regularly spaced expansion and construction joints. The membrane and the wearing surface have ruptured, principally at the joints, but it is still impossible to trace all the sources of leakage, which becomes an increasing nuisance to cars parked on the floor below. No matter what effort is made to seal these cracks from the top, they will continue to reopen in subsequent years, and what is already a bad condition will become progressively worse.

In an effort to remedy this situation, and partly as an experiment, it was decided to eliminate any waterproofing treatment and wearing surface from the roof decks of the Parking Authority's Ninth and Penn and Fort Duquesne-Sixth Garages mentioned earlier. Since a well-designed concrete mix with careful control during placement should produce about as dense and watertight a material as possible, it was decided to make use of this characteristic of concrete in the design and construction of the roof-slab system. Although site dimensions generally dictate the location and number of the joints required, every attempt was made to keep the roof-slab pours as small as possible, thereby minimizing the chance of crack development. While some cracks have developed in the roof slabs of both these garages, it now is a simple matter to locate and repair them with sealing compounds at much less expense than would be involved where waterproofing and a wearing surface must be removed, and perhaps not in the right locations. Waterstops, although considered, have not been used

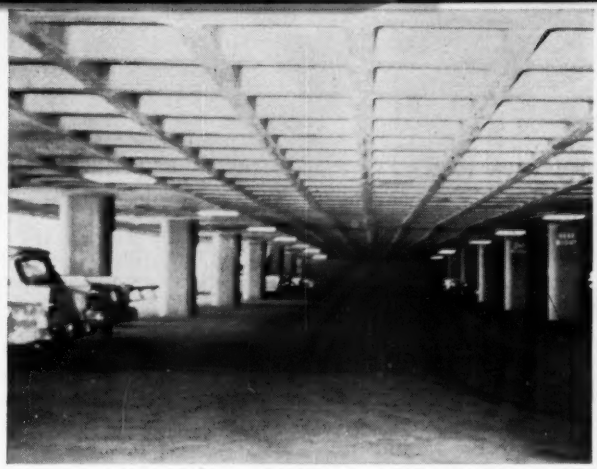


PHOTO 1. A unique lighting system was installed in the Authority's Ninth and Penn Garage. Coffers of the pan-type floor system were utilized as light reflectors by painting them white and installing incandescent bulbs, thus eliminating cost of fixtures. Light bulbs, recessed in coffer units, are protected from car aerials.

PHOTO 2. Porcelainized aluminum panels in two contrasting colors provide eye-catching exterior for Fort Duquesne-Sixth Garage. Use of tapered cast-metal columns at street level eliminated a forest of exposed concrete columns along the building line. Garage entrance and exit are at far right. Vehicular opening at left serves a public alley.

in the floor slabs in any of the Authority's structures to date.

Adequate drainage was a key consideration in the two garages just mentioned. Every attempt was made to locate deck drains at the theoretical low points of a floor. Naturally, one can expect plastic flow and deflection of a concrete slab under live load to gradually create additional low spots where water will collect and create a hazardous condition, particularly when it freezes. The only safeguard against this condition is to "build into" the structure, floor and ramp grades that will insure satisfactory drainage at all times. If this is done, the very critical problem of garage roof and floor leakage—which, incidentally, the writer considers a major unsolved problem in garage design—will be substantially reduced or eliminated.

Sufficient illumination is essential in a parking structure. Adequate lighting is most critical at the entrance where the customer must adjust his eyes from the bright sunlight of the street to a somewhat lower light level inside. Greater light intensity is desirable for the first floor since pedestrian traffic is larger here than elsewhere in the building. If fluorescent lighting is used, fixtures should be equipped with cold-weather ballast to avoid greatly reduced light intensity at low temperatures. Photo 1 shows a unique lighting system used in the Parking Authority's Ninth and Penn Garage.

Larger stalls and increased spans

In the past few years many parking garage designers have become increasingly sensitive to the ever changing dimensions of passenger cars and have adopted more liberal design standards. Recently, self-parking garages with right-angle spaces have been built with a parking module of about 60 ft and minimum stall widths of 8 ft 6 in. The latest thinking seems to point toward a stall width of 9 ft for 90-deg parking. This would mean a loss of one space for every 18 stalls. If the floor area is not critical it would be well to consider the more liberal dimension.

To improve maneuvering while parking, spans bridging an aisle should be increased as much as possible. The ultimate and ideal situation would be a span length equal to the parking module so that columns would be entirely eliminated from the parking and aisle areas. With such a design, stall widths could be varied with changing car widths merely by shifting the floor striping. However, spans of 58 to 60 ft (one parking module) would increase the beam depth substantially. This would in turn increase the floor-to-floor height, the ramp grades, and above all the cost of construction. It is believed that recent developments in high-strength steel and precast and prestressed concrete design may help to minimize most of these objections.

One ingenious clear-span design, developed in the past few years, merits special attention. Photo 2 shows the Parking Authority's Fort Duquesne-Sixth Garage, an angle-parking, clear-span, self-service structure completed in 1959. It is on a Z-shaped site which presented the designer with some very challenging problems from the standpoints of both construction and operation.

Parking at a 60-deg angle is provided in column-free bays adjacent to the one-way upbound continuous straight ramps in the sloping-floor section of the structure. The layout is based on a 52-ft clear parking module for each sloping floor with stalls 8 ft wide. The adjoining part of the structure has level floors with angled stalls served by one-way aisles. Two circular ramps, constructed within the same circular area, serve outgoing traffic and connect these two sections of the garage. In other words, one outgoing ramp is constructed over the other and each serves alternate floors. These two ramps merge near the ground level, as seen in Photo 3.

The express exit ramps speed up the outbound movement of vehicles considerably with a resulting increase in turnover. Experience has shown that parkers have less objection to using circular ramps when traveling down and out of a garage, particularly if the number of levels in transit can be reduced to a minimum. In this garage, the customer travels no more than 2½ complete turns to get down from the top level.

Parkers enter the garage from either of two streets bounding the site and exit to the same two streets. Parking checks are issued by automatic ticket machines (Photo 4) at each entrance and the parker pays his fee at a centrally located cashier counter before he gets his car to leave the building. Attendants stationed at each exit pick up release checks. Three self-service elevators transport customers to and from the parking levels. First-floor space for three retail shops fronting on one of the bounding streets was provided to preserve the commercial character of that street. This open-deck parking garage has a capacity of 605 car spaces on six levels.

Planning for construction

Construction of the garage just mentioned, as well as other parking structures developed by the Pittsburgh Parking Authority, has pointed up several other important items.

Singularly important in building a self-parking garage is the scheduling of elevator construction. Experience in Pittsburgh has shown that, on the average, from 12 to 16 weeks are

PHOTO 3. At this point in Fort Duquesne-Sixth Garage customers have a choice of exits to either of two streets. Massive framing is required to support the circular-ramp section of the building.

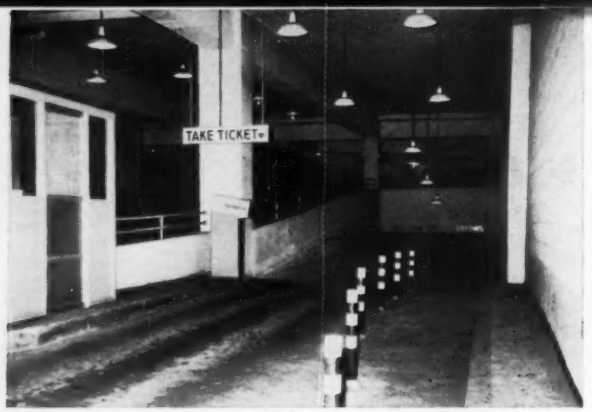


PHOTO 4. Channelizing posts force inbound traffic close to ticket-issuing machine (below sign) in Fort Duquesne-Sixth Garage. Traffic descends to basement level before entering upbound circulation pattern. Exit ramp is at left of booth.

required for the completion of a two- or three-cab installation by the elevator erectors in a six-story garage. This assumes that all shaft and penthouse work will be substantially finished and ready to receive machinery and equipment when the elevator erection starts.

In a reinforced concrete building, it is highly desirable to construct the elevator shaft as an independent structure from the basement or first floor to and including the penthouse roof. This permits construction of the main garage to proceed around the elevators, usually at a slower pace, without interference from, or dependence on, the elevator work. By commencing construction of the elevator shaft at the earliest possible time, there is much greater assurance that all equipment will be installed, fully tested and in operation by the time the garage opens.

Because of prearranged commitments or greater parking demand due to the season of the year, several of the Parking Authority's downtown garages were partially occupied before construction was completed. This situation created many difficult problems, not only for the contractors but for the owner and operator as well. In the case of the Fort Duquesne-Sixth Garage, the Parking Authority had the option, at any time not more than thirty days before the contract completion date, of occupying and operating the parking levels then completed. The general contractor was required to insure elevator service to completed floors and also to provide all barricades, safety signs and warning lights to close off the unfinished parts of the building to the public. In such a case the contractor must anticipate early in the project just how and where he will be able to receive and deliver materials to uncompleted upper floors. Unless he foresees this and other related problems sufficiently far ahead, not only will he reduce the chances of partial occupancy of the garage but he may impose a penalty on himself if the contract so provides.

Operation affects design

The location of directional and operational signs and markings should be established to the satisfaction and with the assistance of the operator. It is very easy for the designer to indicate sign locations on the drawings. However, it is much more sensible to wait until a week or two before the garage is scheduled to open before setting the final position of signs. This is particularly important for directional signs since experience has shown that a beam or column may block a driver's vision of a sign, a condition generally not evident until the building is erected.

Electrical outlets and junction boxes for illuminated signs are a real problem to locate properly before a garage is built. The more complex the floor and ramp framing in a reinforced concrete structure, the greater the likelihood that signs will have to be shifted from the locations indicated on the drawings. Therefore expert judgment is essential to minimize runs of exposed conduit or wiring.

Automobile damage can be reduced to a minimum, particularly in self-service facilities, through careful design by providing adequate sight distance and maneuvering area, easy turns in the traffic circulation pattern and, above all, ample stall width to suit the parking angle. A good example of a measure to prevent cars from being scraped when parked too close to a column is found in the Union Square Underground Garage in San Francisco, where each column is wrapped with a rubber fender. Substantial and well anchored barriers and bumper guards in key locations also can reduce potential accidents, even of a minor nature.

The use of automatic parking devices and equipment in garages has become more extensive in the past few years. Whether it be a ticket-issuing machine, a car space counter, an internal traffic-control system or other equipment, no two installations are exactly alike. A garage designer who believes that all the problems and conditions affecting the location and installation of a ticket-issuing unit, for example, are answered in the manufacturer's catalog will soon find that this is just not so. While a manufacturer may recommend a standard distance between an activating treadle and a ticket machine, the writer has found that this distance should be verified at the site before equipment foundations are placed. The angle of approach to the garage entrance, width of sidewalk, entrance aisle width and direction of traffic after it passes the ticket machine—all these factors must be considered thoroughly by the designer, operator and equipment installer before the mechanical and electrical units are finally positioned.

It is believed that the use of automatic parking equipment will see rapid growth in the years ahead. Public acceptance is bound to increase as garage users become more familiar with automated parking operations.

Good parking garage design is the product of more than the technical mind. It requires full recognition of the primary objective in developing a parking structure, namely to provide the driver and his passengers with the most conveniently located facility and a type of operation that will not create an "obstacle illusion" or lead to confusion in the motorist's mind when he is using the facility. A team composed of the functional planner, the architect or engineer who will do the detailed design, and the experienced parking operator is recommended as the most effective means of achieving better and more progressive design of public parking garages.

(This article is based on the paper presented by Mr. Neale at the ASCE Phoenix Convention, before the Traffic Engineering session of the Highway Division.)

Steel quantities for a simple-frame and a rigid-frame powerhouse compared

B. L. McCORKLE, M. ASCE, Structural Design Engineer, Black & Veatch, Consulting Engineers, Kansas City, Mo.

Analysis of simple framing versus rigid framing for powerhouses shows that the quantity of steel required is 1.2 percent higher for a diagonally braced rigid frame. This conclusion is the result of a study made to determine the comparative costs of these two methods of steel construction. Many applications of welding commonly used in powerhouses were not considered in this study. Such applications include welding of coal bunkers, boiler girders, cover plates on built-up columns and crane girders, roof trusses and small lateral bracing.

The simple frame is assembled with AISC standard beam connections that are not considered to transfer moment between members. Horizontal forces are generally resisted by diagonal bracing, particularly if light masonry curtain-wall construction is used and cracking of the masonry may be critical.

The rigid frame is designed for the complete transfer of moment between members and is assembled with rigid connections. For this study, horizontal forces are resisted by diagonal bracing. When diagonal bracing is undesirable for esthetic reasons or because it is obstructive, it is common practice to resist horizontal forces by the stiffness of the beams and columns and by the rigidity of the connections.

The frames analyzed were similar to those that would be encountered in housing a large power generating unit of conventional type. Both frames

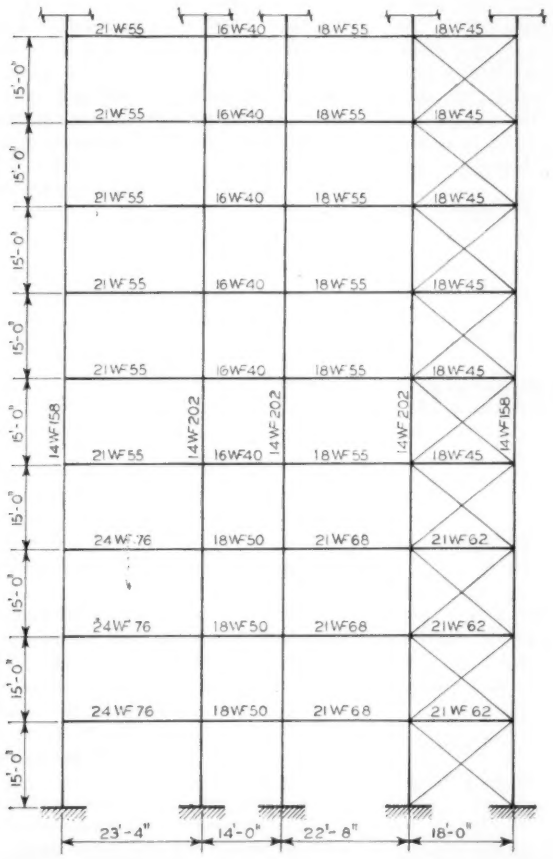


FIG. 1. For simple-frame construction the total column weight is 124,470 lb and the total beam weight 39,710 lb, making the total steel weight 164,180 lb.

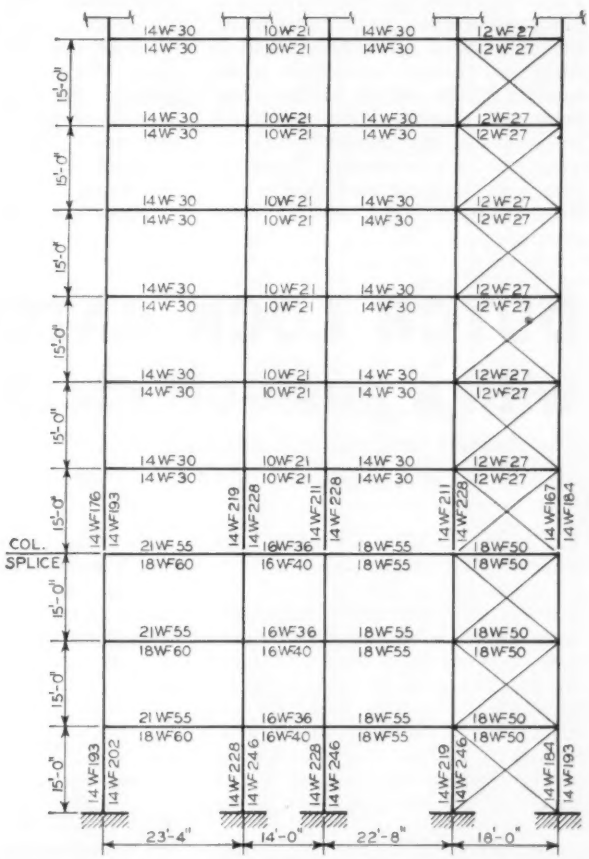


FIG. 2. For rigid-frame construction the total column weight is 141,190 lb and the total beam weight 25,020 lb, a total of 166,210 lb.

were designed for the same loads and for the same allowable stresses. The comparison applies only to the steel on the column rows; an equal number of bays in each direction was assumed. The simple frame is shown in Fig. 1 and the rigid frame in Fig. 2. Sizes above beams and to the left of columns are for beams framing into strong axes of columns. Sizes below beams and to the right of columns are for beams framing into weak axes of columns. As the number of bays in each direction is the same, the average of the two sizes was used as the comparable weight for the rigid frame.

Allowable stress in bending was taken as 20,000 psi. The 20-percent increase in allowable bending stresses permitted by the AISC specification for rigid-frame construction was not used. This decision was based on such considerations as the over-all reliability and rigidity of the structure, and the uncertainty as to live loads, erection and impact loads. Another consideration was the AISC requirement for Type 1 construction that stresses and strains in all members and connections must occur within the elastic range. To satisfy this requirement it is necessary to make "exact" analyses of lateral loadings manually or with a computer. Perhaps an increase in allowable stresses will be justified when computer programs are developed that will solve the complex frames encountered in powerhouses. However, even with computer analysis it is difficult to determine the "exact" stresses in the lower stories because of the indeterminacy of column-base fixity and foundation restraint. From past experience, criteria typical of large powerhouses were used as follows:

Story height is 15 ft, an average for powerhouses.

Column spacings are varied, typical of powerhouses.

Ratio of concrete floor areas to grating areas is 1 to 2. Three concrete floors and six grating floors were used.

Concrete floors are loaded with a dead load plus live load of 300 psf.

Grating floors are loaded with a dead load plus live load of 120 psf.

Column sizes shown on the simple frame, Fig. 1, were not calculated but average 185 lb per ft. For simplicity, changes in the size of columns from axial loads were ignored. In several powerhouses of simple-frame design, the columns weigh an average of 185 lb per ft. This average size does not vary much from bottom to top of columns as heavy loadings such as coal bunkers, boiler girders and air heaters are generally located near the tops of the columns.

The increased column sizes for the rigid frame shown in Fig. 2 are solely the result of the bending moment introduced from the rigid beam connections. This is because, to simplify comparison, the axial loading for each column in the rigid-frame design was assumed equal to the total allowable axial loading for the column size used in the simple-frame design.

Maximum moments in columns and beams were determined by loading adjacent and alternate bays as required. Moment distribution was limited to two cycles as illustrated in the Portland Cement Association's pamphlet, "Continuity in Concrete Building Frames." Columns are considered fixed at the story above and below the point in question.

Conclusions

This study indicated that rigid framing requires 1.2 percent more steel than simple framing. Also rigid connections are generally more elaborate and expensive than simple connections, particularly when beams framing into the columns differ in depth. It is concluded, therefore, that no saving is effected in powerhouse construction by using diagonally braced rigid framing instead of simple framing, unless increased allowable stresses are permitted.

Consideration of power plant columns will show why comparative steel weights differ in various types of structures. Powerhouse columns generally have longer unsupported lengths than those of commercial buildings. These longer lengths result in a penalty for the rigid-frame design as columns do not efficiently resist bending moments.

Columns in powerhouses account for approximately 30 percent of the total steel weight whereas in commercial buildings the columns account for approximately 15 percent. This also results in a penalty for the rigid-frame design.

DUTCH LOCK GATES with a push-off mechanism

J. P. JOSEPHUS JITTA, Chief-Engineer-Director (Retired)
with Rijkswaterstaat (Government Public Works) Voorburg, Netherlands

Lift gates for operation under high loads at locks are generally constructed in such a way that no sliding friction can take place during movement. Therefore they are usually provided with wheels or are of the Tainter type. Between the gates and the abutments there has to be some play, and this area is made watertight by a rubber seal. If rubbing occurs, the seal wears out quickly; the degree of watertightness becomes less and water is lost through leakage.

Systems of gates are sought that will develop little or practically no friction during movement—and also designs that will seal off the water without the use of rubber so arranged that it must slide over the concrete or steel of the structure during movement. Actually the new designs provide better watertightness in the long run. In one system that has given satisfaction, the gates are provided with a push-off apparatus.

First gates with push-off mechanism

The first gates in Holland equipped with a push-off apparatus were those built for the locks of the canal that connects Amsterdam with the Rhine—built some years before the Second World War. When an upward force is exerted on the levers, on the shorter arms of which the wheels are fastened, the wheels will push outward. See Fig. 1 (*a*). Thus they hold the gate laterally against the water pressure. If the presure is W, and the ratio between the arms of the levers is $a:b$, the force needed to push off the gate is Wa/b.

The pressure of the gate on the lock floor must be larger than the force required to push off in order to prevent the gate from being lifted as soon as it is free from the seals. On the lifting rod T, a stop piece N is fastened. After N comes against the stop plate, S, which forms part of the gate, the levers will not turn further on their axes and the gate is raised. See Fig. 1 (*b*).

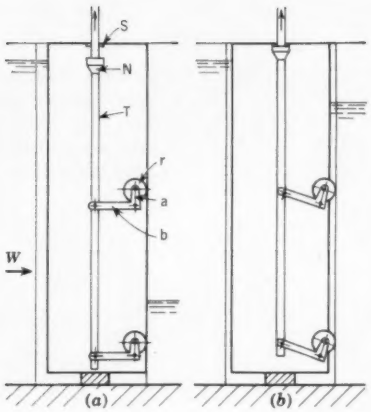


FIG. 1. Gate with push-off apparatus is pressed tight against seal in (a), has just been freed from seal in (b). Water pressure is in one direction only. S = stop plate on gate, N = stop piece, T = lifting rod, r = wheel, a = short lever arm, b = long lever arm.

As the gate is lowered during closure, it reaches the lock floor while the stop piece *N* is still touching the stop plate *S*. The winch must continue to move until the wheels, *r*, are loose from their rail. When the pull stops, the levers cease to be stressed, and the pressure of the water pushes the gate against the seals without stressing the wheels. If the water pressure can come from two directions (for instance, in tidal ebb and flood), levers are placed on both sides of the gate.

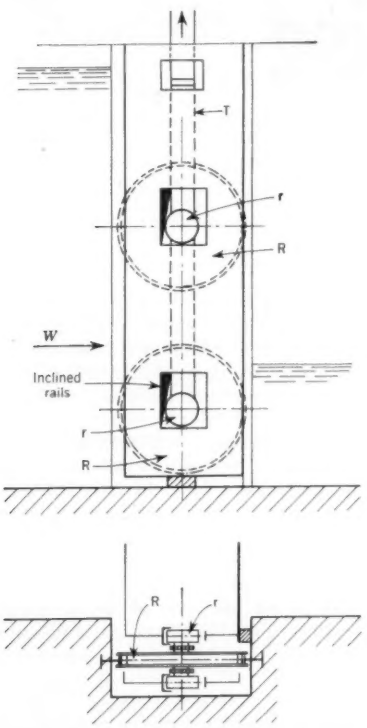


FIG. 2. Where water pressure on gate is very strong (in one direction), heavy push-off mechanism is used with two sets of wheels. One set, r, roll on inclined rails while the larger set, R, roll on vertical rails and turn in the opposite direction. The inclined rails are part of the gate; the vertical rails are fixed to the supporting concrete structure.

Where the water pressure is very strong, another push-off system has been designed for use (Fig. 2). During the push-off period the wheels *r* roll along inclined rails, turning in a direction opposite to that of the wheels *R*, which roll along vertical rails. The inclined rails are part of the gate; the vertical rails are fixed to the concrete supporting structure. If the inclination of the inclined rails is 20 : 1, the push-off force, by pulling the gate with a force of 100 *t*, is 2,000 *t*.

As long as the push-off apparatus is not working, the gate must press on the floor with a force of at least 100 *t*. In the period during which the gate is being pushed off, it moves a little laterally and rubs along the floor. The pressure on the floor disappears fully or partly when the push-off force comes to bear on the gate, so that the friction resistance is zero or quite small. In these calculations, friction between wheels and shaft has been neglected.

If the water pressure against the gate alternates between ebb and flood, the push-off apparatus consists of inclined rails on both sides of the wheels, *r*. The installation works independently of the direction of the horizontal water pressure against the gate. It is according to this principle that the vertical-lift gate 81 m long (265 ft) for the new surge barrier on the Hollandse IJssel near Rotterdam has been built. Since this gate is not lifted when the water pressure against it is high, the wheels are much lighter than would otherwise be necessary.

It is not true, as is often thought, that the force needed to push off the gate must be added to that required to lift it. The wheels *r* give their rails an upward component, equal to the pulling force, so that the gate becomes relatively as much lighter as the pull required to keep it in the pushed-off position.

To perfect the watertightness in the water seals, a rubber strip can be applied. After the gate has been pushed off, the rubber must be free from the seals so that it will not rub over them as the gate moves. This would quickly wear out the rubber.

A push-off apparatus for Tainter gates is illustrated in Fig. 3. The lifting cable is attached to the long arm of a lever hinged at point *a;* this arm is fixed to the culvert wall. The gate is hinged at point *b* on the short arm of the lift lever. When an upward force is applied to the lifting cable, the gate is first pushed against the water pressure and away from the seal. Shortly after this initial movement, the end of the long arm of the lifting lever comes in contact with the stop *S*. The gate is then lifted off the floor by mechanical means.

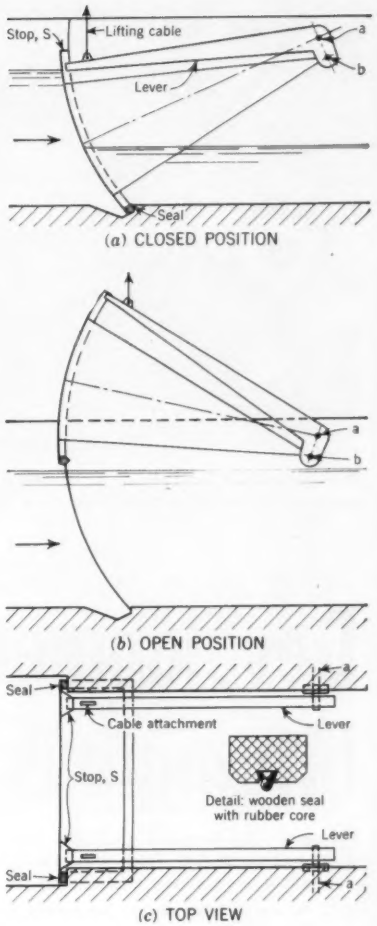
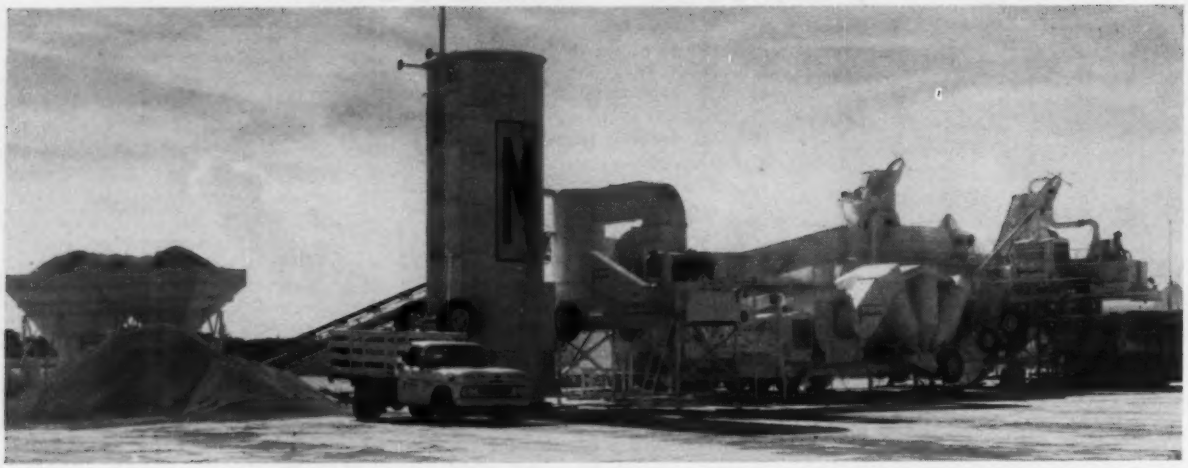


FIG. 3. In push-off system for Tainter gates, the lifting cable is attached to the long arm of a lever hinged at point a, while gate is hinged at point b.

The water seal is of wood with a rubber core as indicated in Fig. 3 (*c*). The gate should be heavy enough to prevent its being lifted by the upward water pressure exerted under its curved portion. In the illustration, the center of curvature of the gate is at point *a*. By moving the center of curvature to a point between *a* and *b*, the amount of uplift exerted by the water will be decreased. The force required to move the gate, however, will be increased.



Despite its clean look, this is an operating continuous-mix plant. Effective dust-control equipment on this highly mobile Barber-Greene spread permits it to operate in residential areas. Mobil Asphalt Co. painted it white to emphasize its cleanness.

Developments in bituminous concrete paving

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New techniques and new equipment offer added economies in bituminous concrete pavement if the specifications make it possible to take advantage of them. Paving involves several different but related work activities. Each activity must be synchronized and the equipment balanced with other operations so as to avoid bottlenecks that will reduce overall production. Conversely, there is no profit in unneeded equipment that is standing by.

The motoring public judges the value of a pavement by its riding quality. Over the years this generally is a good criterion but cost is also an important factor. Cost can be controlled and quality maintained if prompt use is permitted of new machines and improved methods developed by the manufacturers and the many progressive engineers working on paving.

Compaction is of first importance

Good paving starts far below the surface. The service behavior of a flexible pavement depends to a considerable degree on the adequacy of support in the base and subbase courses. Depressions or ruts that appear in the wearing course are very often traceable to a lack of supporting power in the underlying foundation.

Supporting power is dependent on adequate drainage and compaction of the foundation materials since vibratory stresses from traffic can be transmitted as much as 3 to 4 ft below the pavement surface. Probably all soils that are considered granular should be compacted to a value approaching their maximum compactability. Such soils, including those with a slight degree of plasticity or none, should have their moisture density compaction curves developed by AASHO test method T-180.

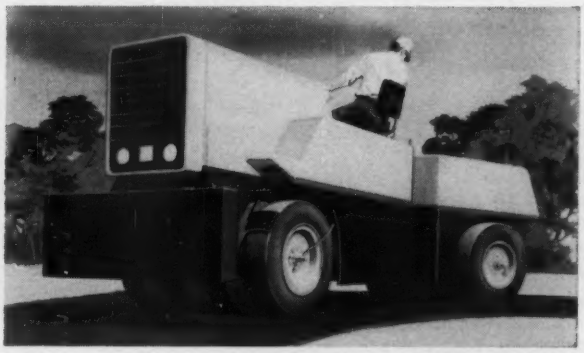
Recent experience in base-course construction shows a trend towards greater use of vibratory compactors and high-pressure pneumatic-tired rollers, that is, those with a contact pressure range of 80 to 90 psi. The vibratory types are more effective for macadam and clean gravel materials where the percentage of air voids is considerable. Pneumatic rollers do an excellent job of densification on bituminous concrete, stabilized materials and the gravel-clay types of base courses. The new self-propelled pneumatic-tired rollers are adaptable for use on various types of soils and base materials, as well as bituminous pavements.

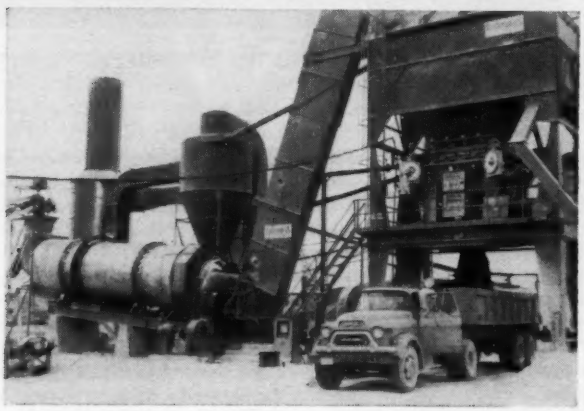
For both soils and bituminous concrete, the first requisite for a good surface is the adoption of a measurable engineering yardstick or end-result that will give reasonable assurance of the stability of the surface during its service life. It is not sufficient to specify that a material shall be "thoroughly compacted" or to use other indefinite terms that cannot be readily checked with some yardstick.

In general, a requirement based on laboratory density appears desirable since it can be achieved on the job without crushing the aggregate or increasing the bitumen content. At the

Seaman Tri-pactor can provide steel-wheel, vibratory, or pneumatic compaction singly as well as pneumatic compaction combined with either steel-wheel or vibratory compaction.

A new Hyster roller has dashboard control of ground contact pressure from 52 to 90 psi by adjusting pressure in tires. Center-point steering provides a short turning radius.





Typical batch-type bituminous mixing plant. Aggregate, fed by conveyors to drier kiln at left, is hoisted by enclosed hot elevator to bin, where screens separate it into as many as four sizes.

This rubber-tired bituminous paver laid more than 110 fpm of bituminous material 2 in. thick and 12 ft wide on Baltimore's Friendship Airport. Paver-finisher has fully automatic controls from hopper to screed.

same time, it allows for bleeding during the summer and a small degree of densification under traffic. Experience indicates that a range of 95 to 98 percent of the laboratory density provides a desirable degree of compaction for bituminous concrete pavements.

Lack of over-all balance in equipment may start at the mixing stage and may be aggravated by obsolete or inapplicable mixing-time requirements resulting in the utilization of only 50 to 75 percent of the capacity of a modern plant. Pugmill capacity is also a consideration but it is more likely to be the dryer capacity or even the hauling capacity that determines the production rate of the total plant.

Much of the synchronization or balance of a modern bituminous mixing plant is now accomplished by automation. With the use of electric and hydraulic controls and timing devices, a single operator can start the whole plant and watch it go through the various cycles until the finished product is discharged into trucks.

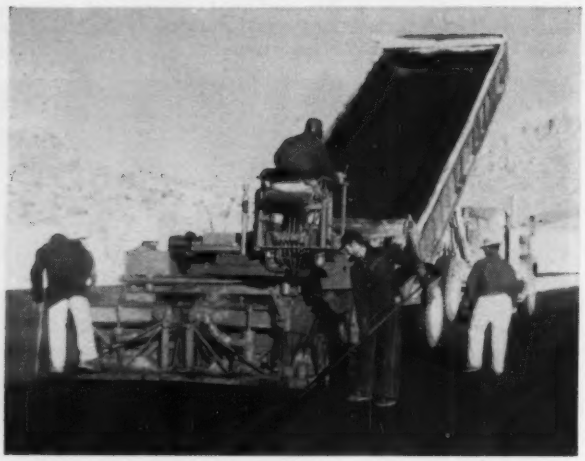
There are three areas where lack of capacity and synchronization can slow down or stop the entire operation. First, the proportions of aggregates at the cold feeder must be roughly balanced so that there is always an ample supply of each size of stone in the hot bin. Most modern plants have multiple bin control at the cold feeder, which practically eliminates the possibility of a shortage of any size in the hot bin. Second, the capacity of the dryer must be such as to assure the desired degree of moisture removal from the aggregate. Here is an area where a little overcapacity is good insurance. Automation has already been introduced in some medium-sized dryers so that the intensity of the flame and the heat applied are automatically adjusted to the amount of moisture in the aggregate as it comes from the cold feed.

If the production lag is at the pugmill, there may be mechanical trouble or the blade setting may be wrong. The pitch of the blades must be adjusted for the character of the mix ingredients, and the efficiency of the pugmill must be maintained by the prompt replacement of worn parts. Permissible blade wear is well defined in the mixing operation of other paving materials. Recently a positive control has been recommended for bituminous mixers to assure compliance with the allowable tolerance.

The bituminous concrete paving industry will soon have an opportunity to take advantage of automatic controls in the pavement laying process. At least two systems of automatic control of profile and transverse slope are in process of development and field testing. One system is capable of following any of several grade references, including a rail, pipe, or steel wire installed parallel to the finished grade just outside the pavement edge.

Another system employs an infrared light source as the reference on tangent grades. On vertical curves, the grade can be obtained by offsetting from the tangent grade reference or by one of several programming meth-

Infra-red heater, hung from paver, conditions abutting cold material to assure a weather-tight and smooth joint.



Rubber-tired Smith paver-finisher places bituminous surfacing on a highway near El Paso.

ods. It is believed that the infra-red following system could be adapted to any type of equipment that works to a finished grade line. The use of an infra-red grade reference in bituminous concrete paving may make it more practical to pave at night in order to avoid peak traffic in urban areas or the extremely high working temperatures sometimes encountered in daylight hours.

Thin blanket resurfacing

Experimental controls for applying thin blanket resurfacing (1-in.) on low-standard pavement are reported by W. H. Crawford in *California Highways and Public Works*, March-April 1961. "The experimental paver control employs a grade-following system on one end of the screed and a transverse slope control, which will cause the other end of the screed to follow the first, thereby maintaining a constant preset transverse slope on the paved surface. . . . Drive motors are connected to respective screed adjusting screws to allow automatic operation. The grade-follower arrangement can be transferred from one side to the other to suit job conditions. Transverse control is accomplished on the opposite side."

Anticipatory action in detecting undulations is obtained by having the follower arm extend well forward. Theory and practice show that roughness is reduced about one-half in each succeeding layer of surfacing. The leveling device is said to greatly improve the operation of a floating-screed paver.

While a high degree of smoothness in the finished surface is very desirable from the standpoints of ridability and safety, conceivably it could be obtained with a base or binder course containing depressions and high spots. If the pavement structure is to function properly, the constructed thickness of the various layers should closely approximate their design thickness. To achieve this objective, a smooth base plane must be used at the start. Each succeeding pavement layer must be placed in a plane parallel to the finished pavement grade and crown.

Production limitations

Several states require a specific number of rollers per tonnage or area of pavement placed per hour. Such requirements do not appear to be always related to the ability of the rollers to produce a dense or smooth surface. For example, a single roller whose output is limited to 25 or 30 tons per hour may be performing at only a fraction of its work capacity. The output of a paver-finisher would be limited to about 8 sq yd per min for each roller placed behind it. Production studies made by the Bureau of Public Roads show that three-wheel rollers, operating in forward and reverse rolling, covered over 40 sq yd per min on a 1-in. mat while meeting a density requirement of 95 percent of the laboratory mix.

Specifications in some instances require that rolling continue until all roller marks are eliminated from the pavement, with no specific tie-in to the density of the pavement. One specification requires a breakdown roller for each 25 tons of bituminous concrete placed, but permits this tonnage to be increased if field laboratory tests disclose that the proper density is actually being achieved on the job with fewer rollers. Contractors state that this provision has not removed the production bottlenecks or increased economy of construction because portable laboratories do not reach the work in time to make the density tests as soon as paving begins.

This tonnage limitation means that an excessive number of some units must be provided to meet the requirements of the specifications—units that perhaps are not needed to equal the productive capacity of a modern paver-finisher. The 1960 California standard specification requires that "the contractor will be required to furnish a minimum of one 12-ton three-wheel roller or tandem roller, one pneumatic roller, and one 8-ton two-axle tandem roller for each asphalt paver." This is believed to be a reasonable requirement and is representative of current practice in a number of states. On a southwestern job, proper paving was secured with only one breakdown roller at a rate in excess of 2,000 sq yd per hour of pavement placed.

The ideal solution would be a set of specifications based solely on the end result for in-place density and pavement smoothness, with no reference to detailed equipment descriptions or production ceilings.

Full advantage of developments in equipment and methods in bituminous paving, or other types, can be gained only by keeping experimental work in pace with the activities of manufacturers. It is also important that specification writers and those who have authority to accept changes should keep pace with new knowledge in the field. But, and this is most important, those in authority must have the ability to determine what is dependable and the courage to accept it promptly. Only in this way can technological improvements be made to pay off.

Balloting on 1960 Conference on Civil Engineering Education Reported

The ASCE Committee on Engineering Education, at a meeting held at the University of Tennessee May 19-20, 1961, reviewed and announced the results of balloting on the resolutions presented at the 1960 Conference on Civil Engineering Education, held at the University of Michigan last July. The conference was held under the auspices of the National Science Foundation, and was sponsored by ASCE, the American Society for Engineering Education, and The Cooper Union of New York. The Committee was assisted by the following five-man Advisory Group appointed by President Holcomb: Lee H. Johnson, Jr., member of the ASEE Committee on Evaluation of Engineering Education, 1952-1955; F.B. Farquharson, member of the ASCE Task Committee on Professional Education, 1953-1957; Cornelius Wandmacher, member of the 1960 Conference Planning Committee; Ralph E. Fadum, representing the Civil Engineering Division of ASEE; and William P. Kimball representing the Education and Accreditation Committee of ECPD. Dean Kimball prepared this report under the instruction of the Committee on Engineering Education.

Civil engineering departments and official delegates to the Conference on Civil Engineering Education, held at Ann Arbor, Mich., in July 1960, were asked to vote on acceptance of resolutions approved by that Conference.

The results reported here are based on ballots received from 98 of the 144 accredited civil engineering departments polled and from 95 of the 139 official conference delegates—received up to the date of the Committee's meeting, four days after the announced closing date for receipt of ballots. Final results, including all ballots received, will be published later.

The Committee expressed its deep appreciation of the cooperation of the responding civil engineering departments in overcoming the difficulties caused by late publication of the conference papers and meeting the May 15 closing date. It noted with interest that 86 of the responding departments and 79 of the responding official delegates authorized identification of their votes in the published results.

The resolutions and results of the ballots on them are shown in Appendixes I and II. As indicated in Appendix II, departmental results are based on the majority vote of members of the department voting *Aye* or *Nay*. In the few cases where the majority vote of the department favored abstention, no department vote is indicated. Results of the individual and department balloting on the resolutions and of all balloting on the extensive opinion survey circulated by the Committee will be analyzed in future studies to be conducted by the Committee and its Advisory Group.

The Committee has summarized the results of the official delegate balloting on resolutions as follows:

1. A majority of the official delegates favors the conference theme resolution on moving toward a pre-engineering program and extending the total period of education. (Resolution 1: *Aye*, 52; *Nay*, 33; *Abstaining*, 6) (Resolution 10: 44, 35, 10.)

2. Because of the wording of Resolution 2, the results are considered meaningless.

3. A majority favors abandoning the "civil engineer" degree as a non-resident, non-academic degree in order to permit its use for recognition of scholastic accomplishment in resident civil engineering education at the graduate professional level. (Resolution 3: 80, 7, 3.)

4. A majority favors the establishment of graduate professional schools of engineering, offering programs leading to the degrees of Master of Engineering and Doctor of Engineering in the several specialties, as well as the continuation of current university graduate schools offering programs leading to the Master of Science and Doctor of Philosophy degrees in engineering specialties. (Resolution 4: 66, 19, 7.)

5. A majority does not favor the development, in colleges of arts and science, of a three-year undergraduate pre-engineering program for all engineers, not to include engineering science, followed by a three-year engineering program (in schools of engineering) consisting of engineering science and professional courses extending about as far as present master-degree programs and leading to a professional degree in engineering. (Resolution 5: 7, 79, 2.)

6. A majority favors individual effort and joint action by ASCE and ECPD to achieve and maintain truly professional standards of performance and ethics among civil engineers. (Resolution 7: 71, 5, 14.)

7. A majority favors increased and articulate recognition by civil engineering faculties of the significance and importance of education in the basic scientific and general cultural subjects. (Resolution 8: 63, 9, 18.)

8. A majority favors meeting the broad spectrum of needs of the civil engineering profession and perfecting educational programs for the more gifted students on a school-by-school basis with the encouragement of experimentation and free exchange of experience. (Resolution 9: 73, 9, 8.)

APPENDIX I. Conference resolutions and results of official delegate ballots received to May 18, 1961

RESOLUTION NO. 1

(*Aye*, 52; *Nay*, 33; *Abstaining*, 6)

WHEREAS, the report of the ASCE Task Committee on Professional Education, published in 1958, revealed that a large proportion of the membership believes that contemporary civil engineering education falls far short of meeting contemporary needs, and

WHEREAS, two-thirds of the membership favors extending the period of undergraduate study to five years, and

WHEREAS, the work of the civil engineer is becoming increasingly interwoven with and vital to man's economic, political, and social well-being and

WHEREAS, modern technological developments are ever widening the vistas of civil engineering and deepening its scientific roots, and

WHEREAS, these trends are constantly accentuating and creating needs that can be met only by truly professional people whose education has the breadth of a liberal education and the depth of a firm foundation in mathematics and science, and

WHEREAS, professional education can fully realize its objectives only as it can grow out of the breadth and depth of pre-professional studies, and

WHEREAS, a learned profession will grow and prosper in proportion to the creativity and vision engendered by continuing research and study at its frontiers,

Advisory Group to ASCE Committee on Engineering Education meets at University of Tennessee for review of balloting on resolutions presented at 1960 Conference on Civil Engineering Education. In front row (left to right) are: Kenneth B. Woods, Clarence H. Ax, Vice President Don H. Mattern, and Alfred R. Golze; in middle row: Frederick B. Farquharson, Director Fred H. Rhodes, Jr., and William P. Kimball; and in back row: Don King, Thomas B. Sear, Ralph E. Fadum, Lee H. Johnson, Jr., Cornelius Wandmacher, George Langsner, and Gene M. Nordby.

Therefore be it resolved, that this conference favors the growth in universities and colleges of a pre-engineering, undergraduate, degree-eligible program for all engineers, emphasizing humanistic-social studies, mathematics, basic and engineering sciences with at least three-quarters of the program interchangeable among the various engineering curricula; to be followed by a professional or graduate civil engineering curriculum based on the pre-engineering program and leading to the first engineering degree, with a civil engineering degree awarded only at the completion of the professional or graduate curriculum, and

Be it further resolved, that increasing opportunities should be provided for qualified students, by progressively more advanced study and research, to earn graduate degrees at the master's and doctor's level, and

Finally be it resolved, that engineering societies in ECPD and EJC be advised of this resolution and be urged to support it by concurrent resolutions in order that unified action will be taken to secure a truly professional educational base for professional engineering practice.

RESOLUTION NO. 2

(*Aye,* 38; *Nay,* 42; *Abstaining,* 9)

Resolved:

(*a*) That the quality of the engineering education program be the predominant objective,

(*b*) That the four-year undergraduate program terminating in the B.S. degree in specific fields of engineering be retained, and

(*c*) That greater emphasis be given to encouraging qualified students to seek the Master of Science, the Doctor of Philosophy and the Doctor of Engineering degrees.

RESOLUTION NO. 3

(*Aye,* 80; *Nay,* 7; *Abstaining,* 3)

WHEREAS, a broad expansion of resident Civil Engineering education at the graduate professional level is imminent, and

WHEREAS, the need for recognition of scholastic accomplishment in a variety of advanced educational programs will be necessary, and

WHEREAS, recognition for accomplishment in the field of engineering practice is now adequately covered by advancement in grade in the Society, and by professional registration, each of which will continue to advance to higher levels of achievement as a requirement for such recognition,

Be it therefore resolved, that this conference favors and encourages the abandonment by all educational institutions of the degree "Civil Engineer" as a non-resident, non-academic degree.

RESOLUTION NO. 4

(*Aye,* 66; *Nay,* 19; *Abstaining,* 7)

WHEREAS, the lead time between a scientific discovery and its industrial application is constantly decreasing, and

WHEREAS, the demand for and enrollment in engineering graduate programs have increased markedly since World War II, and

WHEREAS, engineering undergraduate curricula have been increasing in common-core content, in scientific scope, and in length during the past several decades, and

WHEREAS, a definite need has now developed both for engineers educated for the professional practice of engineering including design and production, or for development and research, and

WHEREAS, individuals suited for either professional practice or for development and research usually differ markedly in temperament and motivation, and

WHEREAS, the engineering profession, the civilian economy, and the defense effort badly need engineers of both such types educated on a doctoral level,

Now, therefore, be it resolved, that the Conference on Civil Engineering Education, sponsored by: The Cooper Union for the Advancement of Science and Art, The American Society of Civil Engineers, The American Society for Engineering Education, and The National Science Foundation, urges the establishment of graduate professional schools of engineering offering programs leading to the degrees of Master of Engineering and Doctor of Engineering in the several specialties, and

Be it further resolved, that the Conference also favors the continuation of current university graduate schools offering programs leading to the Master of Science and Doctor of Philosophy (Ph.D.) degrees in the several engineering specialties, and

Be it further resolved, that a copy of this resolution be forwarded by the Secretary of the Conference to all engineering schools, the Engineering Founder Societies, the State Boards of Engineering Examiners in the United States, and the Engineers Council for Professional Development.

RESOLUTION NO. 5

(*Aye,* 7; *Nay,* 79; *Abstaining,* 2)

WHEREAS, it seems desirable to broaden the humanistic-social base of Civil Engineering education, and

WHEREAS, the cultural influence of the humanistic-social studies is likely to be more effective if taught in the atmosphere of the Arts and Science College, and

WHEREAS, it seems likely that many more potential Civil Engineering students may be enabled to initiate formal preparation,

Therefore be it resolved, that this conference favors the development in Colleges of Arts and Science, of a three-year undergraduate pre-engineering program for all engineers emphasizing humanistic-social studies, mathematics, basic science and communications, followed by a three-year engineering program of engineering science and professional courses taught in professional schools of engineering, extending about as far as present Master Degree programs and leading to a professional degree in engineering.

RESOLUTION NO. 7

(*Aye,* 71; *Nay,* 5; *Abstaining,* 14)

WHEREAS, the problems of professional status for Civil Engineers and of enrollment in Schools of Civil Engineering are problems of the profession as a whole and are not exclusively problems of the Schools of Civil Engineering, and

WHEREAS, the solution of these problems lies in raising the standards of per-

formance and ethics among the practicing members of the profession, and

WHEREAS, the Schools of Engineering can only improve the standards of future engineers, and

Be it resolved, that it is the responsibility of the practicing engineers, through both individual effort and joint action in the professional societies, to achieve adequate standards now and create an atmosphere which will sustain these standards in the future, and

Be it further resolved, that the ASCE and ECPD be urged to take positive steps to achieve truly professional standards of performance and ethics among Civil Engineers.

RESOLUTION NO. 8

(*Aye,* 63; *Nay,* 9; *Abstaining,* 18)

Be it resolved, that the Civil Engineering educator be encouraged to take an articulate position in the profession in order to develop, encourage, and maintain among all engineers and among the interested members of the public, an appreciation of the significance and importance of education in the basic scientific and general cultural subjects, to the end that the engineering student may bring to the college an awareness of these areas of study, and a willingness to apply himself to these subjects as an important part of his educational preparation.

RESOLUTION NO. 9

(*Aye,* 73; *Nay,* 9; *Abstaining,* 8)

WHEREAS, the technological advance has created a need for more civil engineers with graduate school education, and

WHEREAS, modern design requires academic knowledge beyond the traditional four-year academic program, and

WHEREAS, the new tools of the profession such as computers and photogrammetric equipment require more extensive knowledge in the mathematics and physics areas, and

WHEREAS, new problems of air and water sanitation require deeper understanding of physics and chemistry, and

WHEREAS, nationwide programs such as the Interstate Highway Program require Civil Engineers with profound economic and political ability, and

WHEREAS, the operation of American engineering construction firms on a worldwide scale require more Civil Engineers with knowledge of linguistics, world diplomacy and human cultures, and

WHEREAS, these new and recent needs have not replaced the traditional needs of civil engineering which will still supply the major portion of employment for civil engineering graduates, and

WHEREAS, the new needs can be provided for if the more competent Civil Engineering student is given suitable postgraduate education,

Therefore be it resolved, that this conference favors the growth of graduate programs in Civil Engineering in those schools having adequate faculty, adequate financial resources, and employment demand for graduates of advanced programs, and

Be it further resolved, that each school continue to respond to the needs of students, their parents and their employers on a school-by-school basis so that the broad spectrum of needs of the Civil Engineering profession may continue to be met, and

Be it further resolved, that the engineering schools be encouraged to continue and augment these efforts, on a school-by-school basis, in the perfection of educational programs for the more gifted students. Special predoctoral programs starting in the undergraduate years providing for degree study in scientific and cultural areas should be considered. Experimentation and free exchange of experience is encouraged in order that progress may be rapid and the Civil Engineering contribution to the national security and welfare may be significant.

RESOLUTION NO. 10

(*Aye,* 44; *Nay,* 35; *Abstaining,* 10)

Resolved that it be the sense of this Conference that the time has come to increase the length of the curriculum for the first degree in Civil Engineering from four years to five years.

Resolutions 6 and 11 were dropped by the 1960 Conference.

APPENDIX II. Results of Civil Engineering Department Ballots on Conference Resolutions Received to May 18, 1961

(Department results based on majority vote of those voting Aye or Nay)

Resolution No.	Individual			Department *		
	Aye	Nay	Abstaining	Aye	Nay	Tie
1	467	356	95	55	35	3
2	415	360	91	46	41	2
3	727	119	73	82	10	2
4	596	235	87	69	21	1
5	129	708	76	8	82	1
7	689	81	153	87	4	
8	666	73	171	80	4	1
9	698	77	133	83	5	
10	450	372	96	53	35	4

* Two Department abstentions on Resolution 8, one on Resolution 9, and one on Resolution 10.

Air Force Honors Theodore von Karman, Hon. M. ASCE

Theodore von Karman, Hon. M. ASCE, was honored as the world's senior statesman in the field of aerospace sciences on his 80th birthday, May 11, by a symposium sponsored by the Air Force Office of Scientific Research. The symposium was followed by a banquet, which was attended by leaders representing all phases of aerospace activity. Both affairs, which were held at the Sheraton Park Hotel in Washington, D. C., were under the direction of the Institute of the Aerospace Sciences.

The function of the Air Force Office of Scientific Research is to contract for basic research, in areas of Air Force interest, with universities, foundations, other non-profit organizations and industrial laboratories throughout the free world. The Office is itself a result of Dr. von Karman's encouragement of all efforts designed to search out new horizons of scientific knowledge in the aerospace field.

Dr. von Karman, who is currently chairman of the Advisory Group for Aeronautical Research and Development of NATO and honorary president of the International Council of the Aeronautical Sciences, received tribute for his contributions from a series of eminent speakers.

The banquet side of the program, for example, featured Under Secretary of the Air Force, Dr. Joseph V. Charyk as a principal speaker. Dr. Edward Teller, director of the University of California's Radiation Laboratory was toastmaster.

The program emphasized that Dr. von Karman's disciples and students represent a cross section of today's leaders in aerospace educational, military, and industrial affairs. His influence permeates today's thinking in the theory and practice of solid and fluid mechanics and the propulsion sciences.

ASCE was represented on the program by Past President Gail A. Hathaway.

Pipe joints weighing up to 3,750 lb can be strung by helicopter at the rate of more than 150 per day.

PROFITS IN PIPELINE CONSTRUCTION

J. E. DODGE, Flight Engineering Pilot, Petroleum Helicopters, Lafayette and New Orleans, La.

Versatility and cost-cutting—these are the advantages of the helicopter that will dictate its use throughout the pipeline industry. And it is expected that this use will increase as engineers realize the new concepts of time, control, and production made possible by the utilization of helicopters in pipeline construction.

From the historical standpoint, the helicopter normally progresses through two phases before gaining complete acceptance: first comes an initial exploratory or experimental phase, then a period of productive utilization by a few companies.

As regards pipeline construction, this amazing machine is in the second or production phase. It is now being employed by a limited number of companies. But it appears that this period will last only a short time, and that before long the construction helicopter will be in widespread use.

There are two broad areas of helicopter application in pipeline construction. One is the area of heavy lifts in which the helicopter can string pipe and set river weights up to 3,750 lb. The other area is in the provision of mobility and control for supervisory, management, engineering and inspection personnel.

Heavy lifts

Anyone observing a helicopter at work on heavy lifts is impressed by the overall simplicity and speed of the operation—the ease with which the helicopter can pick up and release the pipe, in all types of terrain. The pipe is picked up from a marshaling area or from trucks parked on adjacent roads. The sling-equipped helicopter hovers over the pipe while a ground crew hooks it up, then lifts it gently and speeds to the line at 60 mph, placing the pipe parallel to the line within inches of the designated drop point. The helicopter then returns at a speed of approximately 100 mph. To points within a mile of the pickup site, the average round trip is completed in about 2½ min. By this method, up to 200 joints of pipe can be strung in one day.

River weights are placed in the same way. Experience has shown that such weights can be set directly on the line by helicopter at a rate of up to 200 per day.

In reviewing articles and reports on previous pipeline operations by helicopter, the average pipeliner is easily led to the conclusion that this method of stringing is advantageous only when the terrain makes it difficult to use surface methods. Actually the efficiency of the helicopter is not basically influenced by the condition or type of terrain, whether muddy or dry, flat, hilly or marshy. Regardless of such conditions, stringing capabilities remain relatively constant and the cost advantage of the method accrues to the operating company whatever the condition of the terrain may be. Although this has been shown many times, many companies have yet to investigate this economical and practical means of construction.

Construction control

Supervisory and technical mobility and control are essential to successful job completion. By providing a high degree of mobility and control for per-

sonnel the helicopter can help assure the achievement of this goal.

On a major pipeline construction job in the Southwest, one company was using six spread men who were getting to and from the job each day on horseback. This involved four hours of travel time daily for each man, or a total of twenty-four hours of travel time per day. In terms of non-productive travel time, this represented an expenditure that would have paid for the use of two helicopters, although only one would have been required to do the job.

Most pipelines are first located on large-scale maps, then transferred to aerial photos and inspected by fixed-wing aircraft, while inaccessible areas are checked on the ground. It is in this latter work that the helicopter can be most useful, flying engineers over the proposed route, setting them down at road and river crossings, permitting them to get a close look at terrain obstacles, gradients, soil and rock types. This service alone can eliminate many days of work as well as headaches later on.

Surveying in marshy or open country can best be completed by helicopter. In wooded or broken terrain, the helicopter can fly surveyors without delay to any desired point and aid them throughout the day by flying them over rivers and other obstacles. With such help surveying that would require weeks by surface methods can be completed in a matter of days.

Helicopters can also be of assistance in clearing right-of-way and transporting men and equipment in and out of hard-to-reach locations. During subsequent operations such as welding, X-raying, coating, wrapping and clean-up, the helicopter provides the close control and inspection that is essential in maintaining predetermined standards. For example, the clean-up operation involves putting the right-of-way back into its original condition. Fences must be replaced, new gates and cattle guards installed and ditches returned to working order. Since this is normally a piecemeal operation, a daily inspection by helicopter enables the operating company to keep tabs on the contractor's progress and omissions.

An example of control

An example will illustrate how a major gas company, currently employing an average of six helicopters, utilizes them for supervisory, management and engineering control. A typical day's flight operation includes the following:

1. The chief inspector is flown on daily inspection trips, and set down at each operation site while he talks over pertinent problems with the contractor, checks with his own inspectors and advises them when necessary.

2. Four to six inspectors are flown to and from the job. As they fly along the right-of-way they have a bird's-eye view of the work and are able to secure valuable information on progress not otherwise possible.

3. Company engineers and officers are flown along the line to observe operational progress. Frequently, company officers are picked up at their main offices, flown on a line inspection tour and returned the same day.

4. Other company officials and property owners are flown out to observe specific sections of the line not easily reached by other means.

5. Spare parts are flown out to the contractor to avoid shutdowns, and the contractor's spread men are flown over the line so that potential difficulties that lie ahead or omissions behind can be pointed out to them.

No attempt has been made to mention all possible uses of the helicopter in the pipeline industry. One significant area that has not been mentioned is the pipeline patrol which has been maintained by helicopter by the Columbia Gas System since 1955. On the basis of experience with this patrol, R. E. Eckel, of the United Fuel Gas Company, in a paper presented to the American Gas Association, states:

"The use of the helicopter results in savings of time and productive manhours as well as a reduction in expensive shutdown time due to needed men and/or parts. As we gain experience with the helicopter, we are finding that the limit of its use appears to depend only on constructive imagination. It seems that there is always one more job that you can do with it."

When we speak of the capabilities of the helicopter in pipeline work we are speaking essentially of two things —its ability to save money and its ability to save time. It can usually accomplish the same job done by surface methods at less cost, and nearly always it can complete the same job in less time.

Helicopters bring economy to pipeline construction regardless of condition or type of terrain. This Sikorsky S-58 will deliver pipe lengths to the line at a speed of 60 mph.

Experience has shown that weights can be set directly on the line by helicopter at a rate of up to 200 per day.

Fire-distorted structural steel straightened in place

JOSEPH A. BACCI, F. ASCE, Lt. Col., Corps of Engineers
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Distorted structural steel was repaired in place after a fire occurred in six bays of the Ballistic Missile Early Warning System Transmitter-Computer Building at Clear, Alaska. The fire occurred when the building was about 55 percent completed, 5½ months before the scheduled completion date. A survey of the fire damaged area (a two-story wing of the building) indicated that 250 structural-steel members were severely distorted. Some of the shorter members showed deflections of as little as 4 in. but some of the longer members had suffered lateral deflections of 3 ft. The initial survey, conducted by structural engineers, indicated that at least 30 percent of the damaged members had to be replaced; the remaining members could be reused if they could be straightened.

Looking beyond the sad picture presented by the soot-blackened, deformed structural steel, a delay of two months could be foreseen, to permit removal of the damaged members and the delivery of new ones, not including the delay that would be occasioned by the removal and replacement of other damaged building materials. The total delay would be about three months—to a project that was only 5½ months from scheduled completion. The cost of replacing the structural steel alone was estimated at $200,000.

After an appraisal of this situation, the Joseph Holt Company of Snohomish, Wash., credited with straightening the fire-damaged structural steel at a hangar at McChord Air Force Base after a fire in 1958, was hired to repair in place as much of the steel as possible. The procedure of repairing the steel in place saves the time of disconnecting members and removing them from the structure. The tools used in this method consist of an oxyacetylene torch with a heavy-duty tip to apply maximum heat in a concentrated area. A hydraulic jack mounted on a post is used to exert a constant force on the beams being straightened. Two straightening crews, composed of ironworkers with no previous experience in flame straightening, were employed. One crew worked under the direction of Mr. Holt, the other under the direction of his son Fred.

Straightening procedure

The procedure was as follows. On a beam that is bent vertically so that the top flange is a concave surface and the bottom flange is convex, straightening is accomplished by applying heat to the web of the beam beginning at a point 1 in. below the top flange and extending downward toward the bottom flange so that the heated area becomes wedge shaped, with the greater width at the bottom. The point of heat application is carefully selected. The first heat is applied near the ends with the point of tangency between the straight section and the curved section. Heat is applied so that the area becomes uniformly hot but the temperature remains safely below the point of glow. After the heated metal cools, the point of tangency moves toward the center, and the heat is applied again at the new point of tangency. The number of heat applications depends on the degree of distortion.

The 8 WF beams in the plenum floor were heated on only one side of the web. The webs of the columns and heavy beams in the plenum ceiling were heated from both sides because of the thickness of these members, to give equal heat concentration and so prevent horizontal distortion. At times two torches were used, one on each side; at other times one torch was used on heavy beams as well as light ones, but on the heavier beams the heat was applied alternately to each side until the sequence was finished.

The straightening effect, which appears as a contraction of the elongated side of the beam, is an upsetting action. Metallurgical micrographs indicate that the steel after the straightening treatment actually has a finer metallic grain structure than it had originally. It is significant that during the cooling period for one beam "heat," the crew moves and begins to apply heat to an adjacent beam so that there is no time lost in waiting. Load tests made on four representative beams after straightening indicated that the elastic property of the steel was not in any way affected. All the beams tested showed normal deflections and recovery.

Correcting horizontal distortion

Horizontal distortion was corrected by using two torches when available. At times it was necessary to use only one torch but the same sequence was followed, heating both flanges in the same way the web is heated to correct vertical distortion, that is, heating in pie-shaped sections.

Some of the distorted beams were twisted. This was made evident wherever one flange cooled faster than the other. Such distortion could have been caused by either water or cool air striking the member when the fire was being extinguished. To correct distortion, the same sequence was followed as previously explained; the long sides

One of the last beams to be reconditioned was on the ground floor. At right it is seen in upper foreground, with sag caused by the fire. Below, left, flame straightening is under way with the aid of a jack. Below, right, straightening has been completed.

were shrunk and thus by contraction the beam was rotated in the direction intended. This usually required several sets of heat applications as well as careful planning.

The columns were not damaged to any great extent but many of them had an S-curve in them. This was only slight and usually one to three sets of heat applications brought them to within a "rolling tolerance." Since care had to be taken not to shorten the web of these vital members, the heat was applied only from the heel of the flange to the edge to prevent distorting the structure by shrinking the whole member. If there was lateral distortion, which was the case in two columns, the heat had to be applied to the web but the point of the pie-shaped sequence of heat applications, where the applications were started, was near the center of the web to maintain as much length as possible.

Only three structural-steel members had to be replaced. These were purlins located over an area of concentrated heat. The webs and flanges of these members were so badly damaged that they had to be replaced, using some surplus steel that was on hand.

The entire job of straightening the damaged steel was accomplished in 22 nine-hour working shifts. The working crew consisted of three welders, four laborers and two supervisors. No materials were used other than 160 bottles of acetylene and 200 bottles of oxygen. The cost of steel straightening by the Holt method was less than $45,000.

The "Holt method" was a time saving procedure and did not involve any delay. Actually the straightening was done in less time than would have been required to get new steel on an expedited shipping schedule, not counting the time that would have been needed to dismantle and reerect the structural steel. Much of the ductwork, panels and electrical conduit were cleaned, straightened and reused in place. This would have been impossible had it been necessary to erect new structural steel.

The large savings in dollars and in time, reaped by the use of the flame heat straightening, indicates the potential value to industry of this method in straightening structural shapes and equipment sections. State and federal governments may find this process advantageous in straightening damaged bridge members without interference to traffic. In a time of national emergency the value of this operation for the salvage and repair of equipment might be considerable both to the military forces and to industry.

Aerial view from upstream shows earthfill cofferdam bridge and three cableways. Concrete is at about the stage seen in mid-April by the ASCE tour group after the Phoenix Convention.

Concreting techniques at Glen Canyon Dam

JOSEPH PERAINO, F. ASCE, Chief Engineer, Construction and Marine Department, Merritt-Chapman & Scott Corporation, New York, N. Y.

The story of concreting operations for Glen Canyon Dam on the Colorado River is a story of automation. This arch-type dam—key unit of the Bureau of Reclamation's vast project to develop the Upper Colorado basin—is in a narrow, straight-walled canyon in Arizona 12 miles south of the Utah line. Some 5.2 million cu yd of concrete is to be placed in the dam and powerhouse over a 2,500-day construction period. Merritt-Chapman & Scott Corp., prime contractor for the project, devised a completely automated plant to mix, transfer, and place concrete.

Previous articles on Glen Canyon Project in "Civil Engineering"

- "Design and Start of Construction," W. A. Dexheimer, 1957, July, p. 49
- "Building the World's Highest Arch Span," Francis J. Murphy, 1959, Feb., p. 50
- "$10 Million Construction Plant," Joseph Peraino, 1959, June, p. 50

Cableways will place 4.9 million cu yd of concrete in the 710-ft-high arch dam. This will make it the nation's third largest structure. Also, it will be the fifth largest and fourth highest masonry dam in the world.

Access came first

Access to the area and transportation of materials have been major problems from the start of the project. The closest railhead to the dam site is 135 miles to the south, at Flagstaff, Ariz. The nearest town at the start of the work was Kanab, Utah, 75 miles to the west and north. When the prime contract was bid and awarded, the only vehicular access to Glen Canyon was a narrow, unimproved road out of Kanab. The site area posed an even greater problem for it was split by an impassable gorge 1,200 ft wide, with nearly vertical walls 650 ft high rising abruptly from the river bed. Vehicular and foot traffic had to detour nearly 200 miles to get from one side of the canyon to the other.

First a cable-supported footbridge and then a spectacular arch bridge were built to span the canyon. Located 686 ft above the river, and with a length of 1,271 ft, the steel arch bridge is the highest and second longest such structure in America.

Construction of the Glen Canyon Project called for the excavation of 3,500,000 cu yd of rock, most of it blasted from the walls of the gorge. Huge keyways were carved out on both sides to serve as abutments for the dam. Six tunnels, totaling 18,000 ft in length, were driven through the redstone rock. They include two diversion tunnels 41 ft in diameter, to carry the rerouted river around the construction site; two spillway tunnels that will enable flood waters to pass around the dam; a powerhouse access tunnel; and a control cable tunnel.

To construct Glen Canyon Dam with maximum efficiency within the stipulated 2,500-day period, the contractor mobilized a vast array of equipment and facilities. Virtually the entire plant was specially designed for this project and most of the major units were the biggest ever used in dam construction. The plant is one of the largest ever assembled for building a single structure.

By far the greatest part of the plant expenditure was for facilities to produce and place the more than 4.9 million cu yd of concrete required for the dam and the 312,000 cu yd that will go into the powerhouse and appurtenant structures. Merritt's project plan called for a 38-month concreting schedule with major placing to be done by traveling-tower cableways. To achieve the desired output, buckets of 12-cu yd capacity are used, 4 cu yd larger than had ever before been employed on a dam. Similarly, the facilities to mix, cool and convey the concrete had to be of record size.

Truck haul for aggregates

Glen Canyon's aggregate screening plant was erected five miles north of the dam site close to a tributary of the Colorado called Wahweap Creek, the only source of acceptable aggregate within an economic hauling distance. It turns out three sizes of heavy media products (specified for some 600,000 cu yd of the dam's exposed concrete), and five sizes of natural products that range up to 6 in. in size. It has an intake capacity of 1,400 tons per hour and an output of 800 tons per hour. Conveyor belts servicing the plant have a total length of more than 4,000 ft.

Two draglines with 6½-cu yd buckets, working around the clock, mine the raw aggregate out of the Wahweap pit, where it is loaded onto 27-cu yd bottom-dump trailers and trucked 3½ miles to the screening plant. The material is classified, washed and carried directly to a series of gravity-flow storage bunkers. The plant's storage system is so constructed that the trucks transporting the aggregate to the dam site can be driver-loaded in as short a time as 10 sec.

A fleet of 12 conventional 27-ton bottom-dumps pulled by truck trailers haul the classified aggregate 5½ miles to the dam site. A loaded truck encounters a maximum adverse grade of 1½ percent en route to the site and, including loading and dumping time, can make the round trip in 26 min.

Half a mile from the batch plant, the bottom-dumps are unloaded into hoppers. A belt carries the aggregate onto an overhead shuttle conveyor, which deposits it in one of several stockpiles. The height of the shuttle conveyor permits stockpiling as high as 80 ft.

Batch plant of record size

Heart of Glen Canyon's massive concreting operation is the batch plant, the largest ever erected on a construction project. This plant is 217 ft high—as tall as a 20-story building. It is designed to hold 3,000 tons of aggregate in eight bins. The plant is situated on a ledge carved out of the rock adjacent to the west abutment and is 170 ft below the rim of the canyon, directly below the refrigeration plant.

The batch plant is built around six 4-cu yd tilting mixers and is designed to produce up to 480 cu yd an hour. A series of screens separate the aggregate into eight bins at the top of the plant. Two of these are for heavy-media aggregate. (A minimum specific gravity of 25 is required for all exposed-face, tunnel-lining and powerhouse concrete.) In the control booth of the screening tower a panel with 14 buttons, operated by one man, controls the various gates and conveyors that bring aggregate to the batch plant.

Materials for 1 cu yd of mass interior concrete, in lb

Cement	188	Coarse aggregate:	
Pozzolan	72	3-6 in.	433
Pozzolith	0.70	1½-3 in.	830
Water	94	¾-1½ in.	913
Sand	792	¼-¾ in.	721

Two surge silos adjoining the aggregate storage bins feed in cement and pozzolan through air slides. The pozzolanic material was specified by the Bureau of Reclamation to improve the workability of the concrete while keeping the cement content low to reduce heat of hydration. Air entrainment is required at 6 percent (plus or minus 1 percent) for concrete with ¾-in. aggregate, down to 3½ percent for concrete with 6-in. aggregate. One percent of calcium chloride in the mix is required when the ambient temperature is below 40 deg.

Under the plant's storage bins is the mixing deck where the six big mixers are arranged in a circle and dump into three wet-batch hoppers. Under normal operations, they produce one batch of concrete every 30 sec at an average cycle of 3 min per mixer. Weighing of materials as well as batching and unloading of the concrete into the wet-batch hoppers is entirely automatic.

An electronic unit automatically records the content, cycle and time of every yard of concrete mixed. One man stationed in the control room operates the entire plant. Any of 12 different mixes can be turned out simply by pushing a button.

Seven steel silos, each with a capacity of 10,000 bbl, were erected on the rim of the canyon above the batching plant. They hold 40,000 bbl of portland cement and 30,000 bbl of pozzolan. Cement is trucked in around the clock from Clarkdale, Ariz., a distance of 185 miles, to accommodate Merritt's concrete placing schedule. Every 24 hours, 34 truckloads of cement are hauled to the dam site and 14 truckloads of pozzolan.

Specifications for Glen Canyon Dam require that concrete be placed at a temperature not exceeding 50 deg F, and that after placement the heat of hydration be dissipated by circulating cooled water through embedded pipes. In addition, the con-

Concrete plant was built on the canyon wall 170 ft below the rim. The compressor and refrigeration plant is above it, also with aggregate and cement storage facilities. Trestle for concrete delivery to the cableway is at left.

Aggregate processing was done five miles from the dam. Special equipment was developed to separate light-weight, less weather resistant material from aggregate to be used for exposed concrete. Reservoirs store and reclaim wash water.

struction joints may be grouted only when the temperature is between 40 and 50 deg.

Refrigeration serves two purposes: (1) It reduces the initial temperature gradient between the surface and the interior of the concrete blocks to reduce the probability of cracking; (2) it reduces the temperature of the blocks sufficiently for grouting. Without refrigeration, it could take from 10 to 50 years to dissipate the heat within blocks as huge as those at Glen Canyon. With refrigeration, it requires about two months.

To cool the 4.9 million cu yd of concrete to be placed in the dam proper, Merritt erected a 4,000-ton refrigeration plant with a capacity of 600 tons an hour—the largest single industrial refrigeration installation ever assembled in the United States. In the summer of 1960 the plant's ice output alone totaled more than 10,000 tons, probably more than any other single ice plant in the country. It is possible to place concrete as specified around the clock even when the ambient temperature is as high as 110 deg F, a reading often reached in Glen Canyon.

Neither cement nor sand is cooled before it is batched. Only the coarse aggregate is pre-cooled. The refrigeration plant was designed to: (1) cool the coarse aggregate, (2) supply chilled water and flaked ice for the batching operation, and (3) provide chilled water to be circulated through the cooling pipes embedded in the dam itself.

In the initial cooling process, known as the first cooling stage, the aggregate is sprayed with chilled water at the rate of 2,200 gpm as it moves on a conveyor belt from the storage stockpiles to the batching bins. This supplies the concrete plant with 650 tons of chilled aggregate per hour. Chilled air in sufficient quantity to lower the temperature to 34 deg F—just above freezing—is forced through the aggregate in the batching bins. When the concrete is being batched, chilled water and flaked ice are added to the mix.

Placing concrete

Facilities for mixing, transporting and placing concrete for Glen Canyon Dam are designed to enable each of the cableways to place 24 cu yd of concrete, or two bucket loads, in an average time of 5½ min. Under this system, concrete is loaded at the batch plant into two ladles on a transfer-car unit, moved over a trestle to the transfer platform, and off-loaded into the cableway buckets. After the concrete has been transferred to the cableway buckets, one bucket at a time, the transfer-car unit returns to the batch plant for the next load. The entire cycle takes just 5½ min.

A structural steel trestle 400 ft long, constructed across the west-side keyway 175 ft below the eventual crest of the dam, links the batch plant and the loading platform where the concrete is transferred into the cableway buckets. The loading platform, 13 ft deep, runs along the entire outboard edge of the trestle. A special switching arrangement on the trestle permits two transfer-car units to operate simultaneously.

Special transfer cars, powered by a third-rail electric system, transport the concrete from the batch plant to the cableway buckets that carry it to points of placement. A self-propelled car and an idler car, each carrying a tilt-type ladle, make up a transfer-car unit. The ladle buckets, like the cableway buckets, have a capacity of 12 cu yd. To load a ladle bucket, the transfer car on which it is mounted is moved under any one of three wet-batch hoppers at the bottom of the batch plant. An air-operated gate opens to fill the ladle bucket in 10 seconds.

Once the ladle bucket on the transfer car is positioned directly over the cableway bucket, an air-activated cylinder releases the concrete, one car at a time, by tilting the ladle. Each cableway bucket, the largest ever used on a construction job, is 13 ft high and 9½ ft in diameter. It weighs 9½ tons empty and 33½ tons fully loaded.

Two traveling cableways capable of handling 50 tons each, again the largest and fastest ever used on a construction project, handle the concrete buckets. The cableways have movable A-shaped head and tail towers located on opposite sides of the canyon. These are linked by 4-in. lock-coil steel cable, the largest ever fabricated.

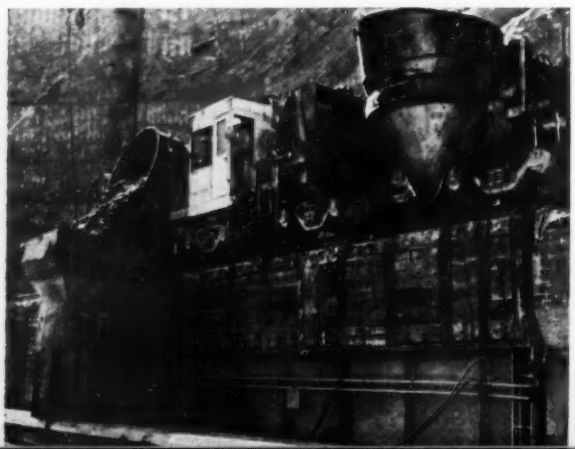
Spans are 1,800 and 2,050 ft, the towers being of different heights and on separate tracks. The specially designed cableways are at different elevations so that one highline can pass directly over the other without interference. They have hoist speeds ranging from 600 to 700 fpm, and can move horizontally with a fully loaded bucket—33½ tons in all—at from 1,200 to 1,400 ft per min. Each cableway is handled via remote control by a single operator.

A third cableway of 25-ton capacity, also equipped with traveling towers, is employed primarily for yarding and powerhouse concreting. It handles an 8-cu yd bucket. Hoisting speeds on this highline range from 450 to 500 ft per min, and its carriage moves horizontally at 1,000 fpm.

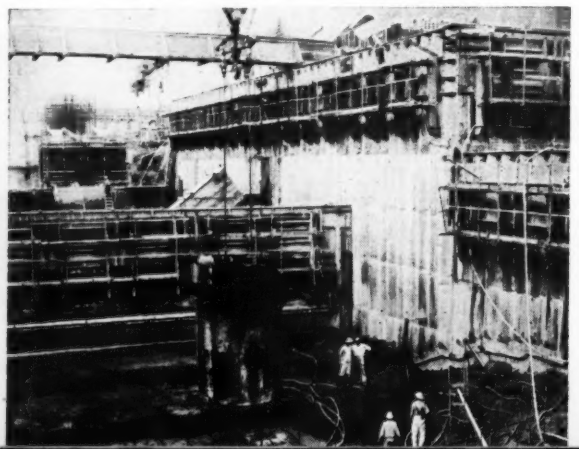
To power Glen Canyon's huge plant—particularly its aggregate, batching, refrigeration and cableway facilities—Merritt-Chapman & Scott at the outset erected a generating plant which initially supplied the growing town of Page as well as the contractor's operational requirements. It consists of 14 diesel generators with a maximum capacity of 16,500 kw, enough to supply the domestic needs of a town of 12,000. Nearly half of the plant's power output is required just to service the batch and refrigeration plants.

Concrete is placed in 7½-ft lifts in blocks ranging from 40 to 75 ft in width and up to 210 ft in length. Cantilever-type steel forms are used for the

Treadwell ladle cars transfer concrete from mixer plant to special 12-cu yd Blaw-Knox cableway bucket.



Cantilever Blaw-Knox forms shape low blocks. Note cooling coils on concrete and on rock foundation at right.



Concrete with gravel up to 6-in. size is placed in 20-in. lifts and compacted by Malin pneumatic vibrators.

Long lengths of panel form are raised as a unit by aluminum A-frames with Tirfor Griphoists powered by hand.

regular blocks of the dam, supplemented as required by forms with interior ties.

The cantilever forms are raised by a series of A-frames with hoists operated by hand winches. Once in position, the forms are held by anchor bolts embedded in the unreinforced concrete 9 in. below the surface of the previous pour. When a new lift is formed, a dummy bolt is set below the top of the form to position the anchorage for securing the form for the next block. More than 150,000 anchors and 5,000 bolts will be used.

With the forms raised and secured, cooling pipes and grout pipes are installed on the surface of the previous block. Cooling pipes consist of aluminum lines of 1-in. diameter placed in continuous coils 30 in. or more apart, over the entire block. Vertical grout pipes, with 7½-ft risers, are placed around the edges of the block so that grout can be pumped into the annular space created by shrinkage after the block has cooled. Glen Canyon Dam will require more than 4.5 million ft of cooling pipe and 2 million ft of grout pipe.

The surface on which the concrete is to be placed is cleaned by sand blasting and washed by streams of water under heavy pressure to assure a watertight bond between lifts. Just before the first layer of concrete is placed, a thin coat of grout is spread over the surface of the previous block.

In placing the concrete, a "bell man" pin-points the desired location of the descending bucket by means of a radio telephone linked to the cableway operator. Inside the block the foreman then releases the hydraulically operated bucket gate by pulling a lanyard at the side of the bucket. Hydraulic power is developed by the weight of the concrete in the bucket. Enough power is stored for three cycles of operation. The bucket can discharge its concrete load in a matter of seconds, or dribble it out. As the bucket is dumped, internal-type vibrators compact the concrete into a 20-in. layer.

A 7½-ft lift, 70 ft by 170 ft, contains about 3,300 cu yd of concrete and can be placed in less than 8 hours. About 24 hours after the lift has been completed, the bolts that secure the cantilever steel forms are removed from the anchors, and the forms are stripped and jacked into position for the next lift.

With the start of each lift, the final cooling stage is put in motion by continuously circulating chilled water through the embedded cooling pipes for about two weeks. In the next phase of final cooling—which can follow immediately or be delayed to suit the convenience of the schedule—chilled water circulates continuously through the pipes for roughly two months, or until the concrete reaches a temperature of 40 to 50 deg.

When this temperature is reached, the vertical joints are ready for grouting. No joints can be grouted, however, until a block 60 ft high has been placed above the point to be grouted —and this block must extend across the full length of the dam. When cooling has been completed, water is drained from the cooling pipes and the lines are sealed with pumped-in-grout —the final step in grouting the 60-ft-high block.

The first concrete in Glen Canyon Dam was placed on June 17, 1960. Concreting continued through the winter, and the millionth cubic yard was placed on May 8, 1961. It is estimated that a total of 1,700,000 cu yd will have been placed when this article is read in mid July. The largest amount placed in a single day was 10,476 cu yd on March 23. For the months of February, March, April and May, the daily average placed in the dam and powerhouse was 8,200 cu yd.

Powerhouse construction

On the floor of the gorge, 470 ft downstream from the axis of the dam, Glen Canyon's Powerhouse is being constructed in an operation almost completely divorced from the work on the dam. In addition to the 25-ton cableway that services the powerhouse area, there is a revolving gantry crane with a 125-ft boom, based at the bottom of the canyon.

Unlike the dam, the powerhouse is being constructed of reinforced concrete. More than 5,000 tons of reinforcing steel and 2,600 tons of structural steel—all fabricated at the site—will go into the 655-ft-long structure. The powerhouse is designed for an ultimate installation of eight 112,500-kw generating units, a total of 900,000 kw. The dam is scheduled to be completed in March 1964.

On a job as huge and complex as Glen Canyon Dam—particularly one with so many record-size facilities of advanced design—operational problems must be expected, and the contractor has run up against the usual amount of "bugs" for a project of this size. Some parts of the plant have been modified but basically it remains unchanged.

Automation, when properly adapted, seems to contribute appreciably to the concreting operation. The job has benefited through the use of advanced communication techniques—principally closed-circuit television—to help control and monitor operations as well as facilities. In the screening-tower control-booth at the batch plant, for example, closed-circuit TV enables the operator to check the amount of aggregate in each of the eight storage bins. Television also is used to keep the traveling towers of the two 50-ton cableways directly opposite each other, and a double system of two-way radio helps the cableway operators to pinpoint concrete placement. Experimental efforts were made to install a TV camera opposite a concrete mixer so that the concrete could be viewed as mixed, but poor lighting, dust and vibration forced abandonment of the idea. So television, for all its wonders, is not the answer to every problem.

(This article is based on the paper presented by Mr. Peraino at the ASCE Phoenix Convention, before a session of the Construction Division.)

Facilities for the Saturn rocket

A new era in America's space capability is rapidly approaching with the evolution of the Saturn rocket under the direction of the National Aeronautics and Space Administration (NASA) at its Marshall Space Flight Center, Huntsville, Ala. Development of this 1,500,000-lb rocket, originally begun under the Army Ballistic Missile Agency (ABMA), was turned over to NASA in 1959.

Part I. Holding the Saturn booster

WILLIAM S. BURKS, JR., Chief, Army Projects Section, U.S. Army Engineer District, Mobile, Ala.

To anchor a thrust of 1.5 million lb for the Saturn booster—ten times as powerful as that of the Jupiter—is the challenge that has been successfully met by the Mobile District, U.S. Army Corps of Engineers.

Major research, as well as development time, was bypassed by the use of an eight-cluster arrangement of uprated Jupiter engines and Jupiter and Redstone fuel tanks. It was the responsibility of the Mobile District to provide a static-test facility to receive the booster as soon as it should be completed, in the accelerated program to hold this tiger by the tail. This task was accomplished at a saving of a year's time and 10 million dollars over initial estimates by modifying one position of a tower originally built for testing Redstone, Jupiter and future missiles having a thrust of not more than 500,000 lb.

The original tower was basically a hollow reinforced-concrete shaft 20 ft by 30 ft, extending 146 ft above ground and 30 ft below. It accommodated vertical mechanical and electrical services, and an inside stairway and elevator. It was supported by a spread footing 75 ft by 65 ft about 30 ft above the limestone bedrock. The intervening red clay soil had become compressed at least ¾ in. during the five years of the tower's existence.

With a maximum allowable soil-bearing pressure of 4,500 psf required to support the Jupiter's thrust, foundation assistance was imperative. Obviously, the magnitude of the static and dynamic loads under consideration called for careful study. Could a modified tower bear the tremendously increased load? The Mobile District, responsible for design and construction of facilities at the Redstone Arsenal, selected Maurice H. Connell and Associates, of Miami, to study the problem and prepare construction plans and specifications.

Major design considerations

Three primary factors influenced the design:

1. The existing tower footing could not tolerate a large eccentric dead load, which would induce uneven settling and tilting of the tower.

2. During test firings, differential movement would be needed while at the same time a fixed relationship was maintained between the new and the old construction. These two problems were met by supporting the new structure independently on point bearing piles driven to bedrock outside the existing spread footing. This required cantilevered support for the inner columns of the new test position since it had to be adjacent to the face of the old tower.

3. The third problem was the possibility of vibration failure under dynamic loading should the vibrations come into resonance with the natural frequency of the tower. Calculated frequencies, however, appeared to be within safe ranges. It was determined that short-duration side loading of the tower, caused by gimballing of the engines, could be tolerated if fairly flexible connections were used. Accordingly, the new structure was designed to be built separately from the existing tower, except for very flexible connections at the load ring. Final design criteria, as determined from load requirements and investigations, are given in Table I.

TABLE I. Final design criteria for Saturn booster anchor

Live Load	Basic Load, kips		Dynamic Factor		Design Load, kips
Vertical thrust	2,000	×	1.5	=	3,000
Horizontal at bottom of flame deflector	2,000	×	1.5	=	3,000
Lateral at top and bottom of flame deflector	75	×	1.5	=	112.5
Horizontal thrust at load ring	150	×	2.0	=	300

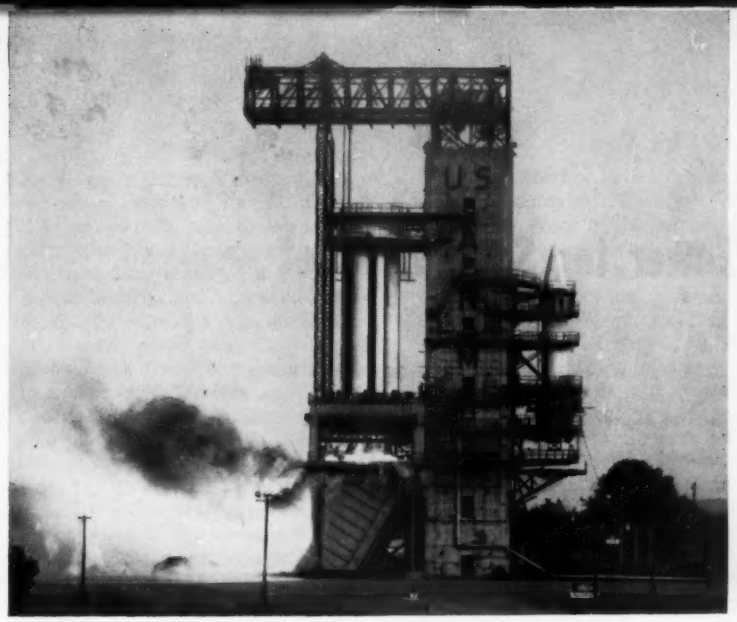
Deflection and uplift

Differential deflection between load platform and horizontal load cells was not to exceed ⅛ in. under a horizontal thrust of 150 kips with a dynamic factor of 1.0. Furthermore the total horizontal deflection with respect to the existing tower could not exceed ¼ in. under the 150-kip horizontal thrust.

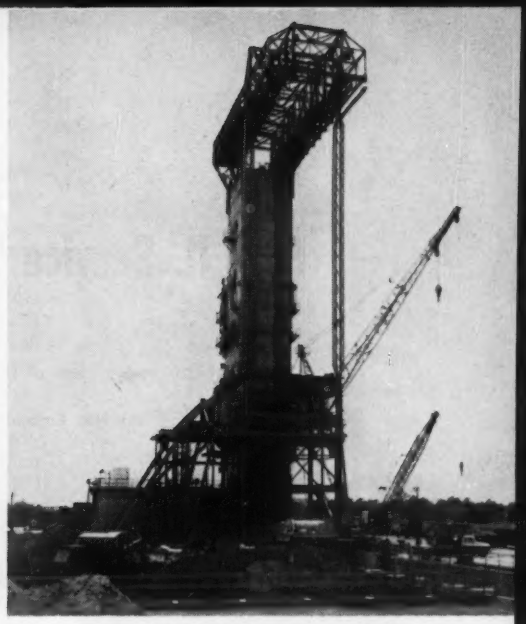
In the accompanying drawing, Fig. 1, the design concept can be traced. Loads from the full dead load of the missile—before firing—to full thrust, together with all dynamic factors such as starting transients and rough combustion, are taken by the load platform. It is a horizontal diaphragm supported at four corners, with a very large opening in the center surrounded by smaller openings for vertical load cells and safety bolts supporting the load ring.

Fifty percent of the uplift is resisted by the reaction of the exhaust from the motors on the flame deflector. Columns connecting the flame deflector to the load platform carry this part of the uplift. The dead load of the flame-deflector pit carries the remainder of the uplift. No uplift is transmitted to the foundation piles.

To prevent the transmission of any



First firing of Saturn booster takes place, using full cluster of eight engines.



Construction view shows a heavy buttress designed to take horizontal thrusts caused by gimballing of the Saturn engines.

horizontal thrust from the flame deflector (3,000 kips considering the dynamic factor) to the original tower at upper levels, which would produce excessive deflections and foundation pressures, the upper end of the flame deflector is set on rockers that transmit vertical loads only. The entire horizontal component is then transmitted to the base of the tower through heavy wide-flange thrust beams, embedded in the flame deflector pit, and stainless-steel bearing plates. The bearing plates permit vertical movement but deliver little vertical load to the tower foundation, either from thrust or from the dead load of the tower addition and missile.

The cantilevered end of the new tower foundation thus is relatively free to deflect in a vertical plane. All vertical loads are carried by bearing piles driven to bedrock and by tension anchors at the outer end of the cantilever. Only lateral thrusts are delivered to the existing tower. These are of such magnitude and at such locations that excessive deflections and foundation pressures will not be produced. Lateral thrust at right angles to the tower is carried by a buttress founded on steel piles driven to bedrock. Here again buttress connections at the load platform are designed to resist horizontal loads only. Deflection criteria generally governed the buttress design.

During missile firing, the crane is parked directly above the original concrete shaft. The crane truss is designed as a cantilever for dead load. Thus, in the event of an accident, which might destroy the two open-truss columns, the crane truss would not collapse.

For fast fueling, liquid oxygen and fuel tanks are located close to the test position. Two 17,500-gal underground fuel tanks are for emergency use.

Instrumentation for static firing was designed by the ABMA Test Laboratory. For the most part it utilized equipment and cables already in use for the Jupiter and Redstone programs. Some 950 channels are employed to record and indicate all the vital characteristics, not only of the missile, but also of the test stand and sound levels generated. Sound power levels in this range have not heretofore been available for measurement. The results may be of considerable interest from the standpoint of damage—fatigue and otherwise—that may result from such tests and ultimately in actual flight. These studies are being continued as part of the over-all program, now transferred to the National Aeronautics and Space Administration.

The Marshall Test Division designed the eight calibrated load cells, the load ring which supports the clustered booster, and the water-cooled flame deflector. Elaborate scale-model tests were conducted to determine the optimum impingement angle for the flame to prevent development of stagnation pressures in excess of water pressure. Such an occurrence would permit burn-through of the deflector and prevent proper cooling. To prevent flame spillover when the engines are gimballed, water-cooled side-wall heights were also developed from model tests.

To provide weather protection for personnel during servicing operations, the working area around the load ring and booster power plant is enclosed by overhead rolling steel doors on the front and sides and by a horizontal rolling deck to close the flame opening in the lower work platform. The work platform cantilevered from the original tower near the top of the booster provides horizontal restraint.

Extensive dynamic study made

The complex interaction of the structures and their foundations necessitated an exhaustive dynamic study. In this study invaluable contributions were made by three outstanding men of the University of Florida, Dr. L. E. Grinter, F. ASCE, Dean of the Graduate School, and Dr. F. E. Richart, Jr., F. ASCE, and Dr. D. A. Sawyer, A.M. ASCE, of the College of Engineering.

The entire project was accomplished on schedule while permitting routine production testing of Jupiter missiles on the west side of the tower. Construction work was suspended only during periods of actual firing.

Demolition and foundation work was done by the J. A. Jones Construction Company, of Charlotte, N.C., under an advance contract. The prime steel contractor was the Chicago Bridge and Iron Company, assisted by The Ingalls Iron Works Company, both of Birmingham. The Dunn Construction Company of Birmingham was the general contractor.

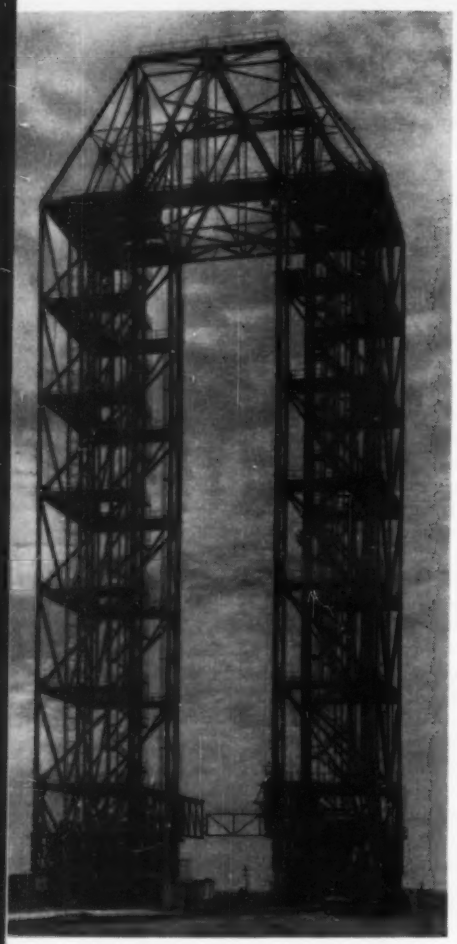
The 100-ton bridge crane, designed and fabricated by the Harnischfeger Corporation of Milwaukee, hoisted itself into place under its own power by an ingenious rigging arrangement developed during design of the structure.

Construction work was supervised by the Mobile District Area Engineer and his staff permanently stationed at Redstone Arsenal.

Part II. Service Tower for Saturn rocket

TOM H. REYNOLDS, Major, Corps of Engineers, Missile Projects Officer, Jacksonville Engineer District

FREDERICK F. IRVING, Captain, Corps of Engineers, Project Officer for Saturn Tower



Mobile service tower for the Saturn rocket is an impressive structure 310 ft high, constructed by Kaiser Steel Company. It weighs 2,800 tons and can propel itself at a rate of 40 ft per min.

The Saturn will give the United States the ability to put an 8-ton payload into space or on the moon. The tremendous size of the rocket necessitated the construction at Cape Canaveral of an entirely new launch complex, which is now nearing completion under the supervision of the U.S. Army Corps of Engineers.

An outstanding feature of the Saturn complex is the mobile service tower 310 ft high. To appreciate the size of this structure it is necessary to realize that the maximum height of previous towers at Canaveral was 179 ft. The design and construction of such a large, mobile structure has presented many new problems.

Function of tower

The primary function of the Saturn service tower is to provide a means of erecting a rocket on the launch pedestal in stages. It is first necessary to mate the several stages or assemblies vertically and then to have a means of access to the many mechanical, electrical and hydraulic systems on the vehicle for checkout and adjustment. The tower is also used for fueling the propulsion stages and for pressurizing the tanks and compartments within the rocket.

In view of the rapid advances being made in space technology, the Saturn service tower was not designed to serve a single rocket but rather a family of large, multistage space vehicles. Versatility and adjustability were therefore built into the tower. After serving its function at the launching pedestal, the tower must be moved to a safe distance during rocket firing operations and must be adequately anchored down to withstand the blast forces that will occur when the missile is launched.

Design features

Since Cape Canaveral is in the hurricane zone, it was decided that the structure, while stationary, must be able to withstand winds up to 120 mph. The mobility requirement was that the tower be capable of self-propelled movement at a speed of 40 fpm against a 46-mph wind. After many refinements, an exceptionally clean design was achieved with a minimum of bracing. This design proved economical from an erection and fabrication standpoint and also presented a minimum area for wind resistance.

The mobility requirement was met by placing the tower on four 12-wheel carriages. Each carriage consists of three rigid four-wheel truck assemblies with wheels of 36-in diameter. These trucks roll on two parallel sets of standard-gage railroad tracks, which are 90 ft apart. The 2,800-ton dead load of the tower requires absolute equalization of load between the three trucks on each carriage. This is accomplished by a hydraulically operated equalizer bar between the carriages and the tower support points. The same hydraulically operated cylinders are used to equalize the load and to jack the tower off the tie-down anchorages and onto the rail trucks prior to movement.

The combined structural dead load and the compressive component of the 120-mph wind overturning moment result in a downward force that made it necessary to install a static tie-down system to function when the tower is free of the wheeled undercarriage. This problem was solved by a system of tower bases and tie-down rails, independent of the wheeled undercarriage, to which are transferred all the compression and tension forces resulting from hurricane wind loading. Tower bases are designed at the four corners of each leg of the tower. They are constructed on steel base plates 4 in. thick, astride steel anchor rails.

Tie-downs are provided at the launch site, so that the tower can brace the rocket in high winds, and also at the "off-pad" site—some 700 ft away—where the tower is anchored during launchings. Positive lock-down of the tower is effected by hydraulically driv-

en wedges which pass through slots in the tower bases and the anchor rails. The anchor rails and base plates are secured to heavily reinforced concrete subbases constructed on a sand foundation, which was compacted to a depth of 28 ft by Vibroflotation.

Traction power for the tower is produced by four 100-hp electric motors. One motor drives each undercarriage, and automatic synchronizing controls prevent skewing. The controls are capable of varying the speed from 1½ to 40 fpm. Ground connections for electricity, water and gases are provided at the launch site. While under way the tower is powered by its own diesel-electric 400-kw generator.

The equivalent of a two-story building is provided in the base of each tower leg to house rocket check-out instrumentation and tower controls. Adjustable service platforms at five different levels can be positioned to conform to the configuration of the vehicle. These service platforms are extended mechanically to fit closely around the vehicle during servicing and are retracted for tower movement. Each platform is enclosed by aluminum panels and is fully air-conditioned. Access to the service platforms is supplied by two passenger elevators and one freight elevator, as well as by stairways.

Construction started last fall

Construction of the tower was commenced last fall by the Kaiser Steel Corporation. Steel was prefabricated at the Bessemer, Ala., plant of the Nashville Bridge Company and finished sections were shipped to the Canaveral site by rail and truck. Structural welding was done in the shop and all welds on material over ⅝ in. thick were given either a radiographic or magnetic particle examination. Twenty percent of all the other welds were similarly examined. All field connections were made with high-strength bolts.

Erection to the 116-ft level was conventionally handled by truck and crawler cranes. At 116 ft it was necessary to begin using guy derricks installed on the structure itself. A special guy derrick platform was fabricated by the contractor to extend between the two legs of the tower, to be bolted to holes in the interior columns for support. This platform provided sufficient space for two guy derricks, each erecting steel on one of the tower legs. The derricks were equipped with 100-ft booms of 20- and 30-ton capacities respectively. The derrick hoist machinery was located on the ground, in line with each tower leg, and utilized the tower railroad tracks as anchors. Using this method it was possible to erect, in approximately 5 days, all the steel within reach of the derricks from each operating elevation. The largest shop-fabricated members of the structure are the 72-ft-long trusses that form the interior columns of each tower leg. These trusses, which weigh about 20 tons, were the determining factor in selecting the guy derrick capacity and boom length.

The derrick platform was set initially at the 116-ft elevation and then moved successively to 188 ft and 260 ft. These movements were made by rigging to temporary catheads bolted to the top of the steel at the next elevation, and then hoisting the entire platform with the derricks in place. Temporary guys held the derricks during movement.

On completion of steel erection, including installation of the bridge crane at the 260-ft elevation, the derrick platform was lowered and disassembled. The 60-ton bridge crane was then used to install the sections of the moveable service platforms which had been preassembled on the ground.

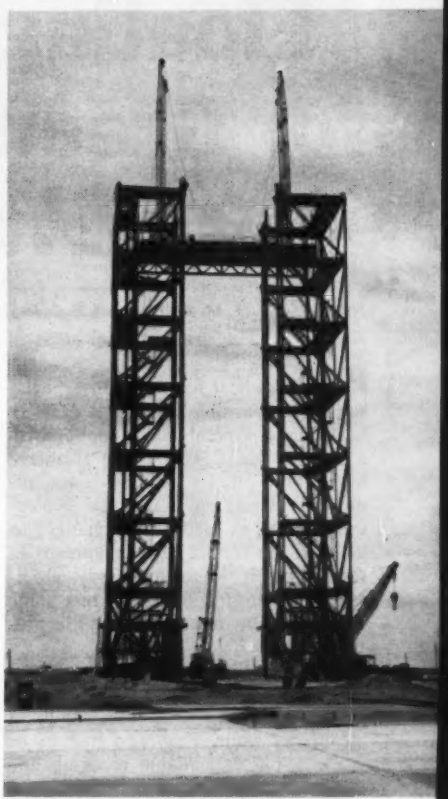
The Cape Canaveral atmosphere is extremely corrosive because of blowing salt spray and sand accompanied by relatively high temperatures and humidity the year round. These conditions dictated particular care in the choice of paint and in its application to achieve maximum protection and long-range economy. All steel was given a shop coat of 90 percent powdered zinc with an epoxy binder. This was followed by another zinc-epoxy prime coat in the field and two coats of international orange epoxy paint.

Design and construction of the Saturn service tower were geared to meet a very tight schedule. Great effort and ingenuity resulted in a relatively simple, economical and functional structure to meet the unique and complex requirements. The total cost of the tower will be $4,500,000.

Construction of the Saturn service tower is under the supervision of the U. S. Army Corps of Engineers, Jacksonville District. The District Engineer is Col. Julian V. Sollohub; the Missile Project Officer, Maj. Tom H. Reynolds; the Area Engineer, Mr. Donald E. Eppert; the Project Engineer, Capt. Frederick F. Irving, A.M. ASCE; and the Cape Canaveral Resident Engineer, Hank Freeman.

Kaiser Steel Company personnel in the field were W. J. Way, A.M. ASCE, Project Manager, and N. M. Schroeder, Project Engineer.

The basic design of the Saturn service tower was carried out by Maurice Connell and Associates, Miami, Fla. Final design was by Kaiser Steel Co.



Tower is under construction to 310-ft height.

One of the two rail beams along which the Saturn Service Tower moves to the launch pad appears in foreground. It is 8 ft high, 10 ft wide and at this point is supported by 8 ft of additional reinforced concrete below ground level. (Final ground elevation will be at top of rail beam.) Beyond is blast wall protecting Saturn Lox area. Towers in center rear are ICBM row, with blockhouses for Titan complexes at right.

Floating power for Greenland's BMEWS station

JOHN R. DAVIS, M. ASCE, Project Engineer, Metcalf & Eddy, Boston, Mass.

Power and heat for the Ballistic Missile Early Warning System (BMEWS) near Thule, Greenland, is supplied by a floating plant. This plant, formerly based at Fort Lauderdale, Fla., required unusual environmental protection as well as mechanical changes to get it ready for its new assignment in the far north. Metcalf & Eddy, architect-engineers for BMEWS, met some unusual problems in providing this protection.

The U.S. Navy's YFP-10 is capable of providing 27,000 kw of electric power while exporting 115,500 lb of steam per hour. Provision had to be made for a dependable mooring and for continuous circulation of condenser water in an area where winter brings temperatures of 35 to 40 deg F below zero, winds of more than 100 mph, and harbor ice 6 ft thick. In contrast to the continuous darkness of winter, summer brings 24-hour daylight, temperatures in the fifties—and the threat of pack ice being blown ashore with almost irresistible force. Water temperatures in the harbor range from 29 to 35 deg F, and the mean tidal range is 5.4 ft, with a maximum of 10 ft.

Ship rebuilt from cargo hull

The YFP-10 was rebuilt from a C1-M-AV1 cargo hull. It has a length of 340 ft, a 50-ft beam, and a displacement of 7,000 tons when fully loaded. Since all propulsion machinery was removed, the vessel must be towed.

Three complete power units, each consisting of a high-pressure boiler (123,000 lb per hour at 625 psig), and a steam turbine-generator (11,500 kw at 85 percent power factor) were installed in the cargo and engine-room spaces of the hull, together with necessary controls, switchgear and appurtenances. Included in the ship are 26 fuel tanks, as well as tanks for potable water and condensate. There is storage capacity for 703,540 gal of boiler fuel and 9,470 gal of diesel fuel for the auxiliary units. Condenser cooling water is provided by three pumps, each driven by a two-speed 25/150-hp electric motor and capable of providing 22,000 gpm.

The floating power plant was winterized at the Bethlehem Steel Company's shipyard in Hoboken, N. J., before being towed the final 3,000 nautical miles to Thule, where it arrived in August 1959. The principal changes made to convert the ship for arctic use were the application of hull insulation, revision of the fuel system, and provision for exporting steam for heating on-base buildings. (Ten of the existing twelve power and steam plants at the base have been retired to standby status.)

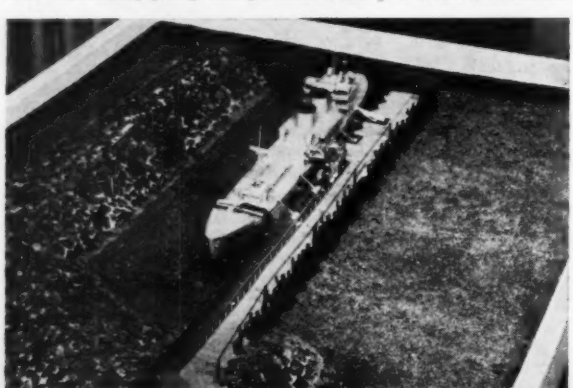
Complete insulation of the hull, deck, and exposed bulkheads was required to control condensation and excessive heat loss. The insulation applied to the outside of the ship begins at a point one foot above the water line. It consists of two layers of 1½-in. polystyrene impaled on metal studs welded to the hull, secured by nylon fastenings, and covered with layers of glass cloth. Epoxy-base resin is applied to top and bottom surfaces of the polystyrene layers, and as a finish coating over the glass cloth. Hull insulation was completed on the inside, where it extends around the bottom of the ship and up to 2 ft above the water line. Special interior insulation is also provided at tank tops, bulkheads, and specific locations in the overhead.

Protected mooring

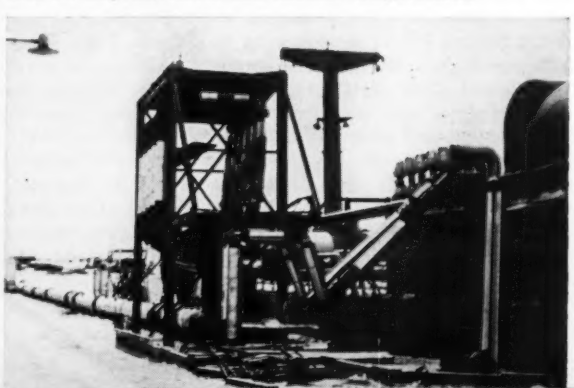
The berthing problem at Thule was to provide protection from wave action and harbor ice, and to minimize all ship motion caused by winds and tides to permit permanent connections to on-base utility systems. Metcalf & Eddy decided on an enclosed basin, and a modified spud mooring system.

Mooring brackets were attached to the port side of the ship at main-deck level for maximum stability against wind forces. Structural steel H-sections, secured to the side of the dock and extending above it, are back-braced to concrete anchor blocks. Connecting members are attached by hinge pin to the mooring brackets and interlock with the H-sections, which act as guides for the sliding members. This system limits lateral and transverse movement to a few inches, but still

Model of floating power plant, built by the writer, had a powered circulating pump that permitted study of water movement.



Jointed and insulated connections to floating power plant provide for ship movement and extreme temperatures.



Steel sheetpile cells protect floating power plant at BMEWS site in Greenland. Open water, in shadow of smoke outside the cofferdam, was heated by condenser discharge and became a winter playground for seals.

allows vertical movement due to tide and draft changes, and listing caused by wind loads and variations in ballast.

The berthing facility is a rectangular basin bounded by a quarry-stone rock-fill and a gravel-filled steel sheetpiling dock. This basin is situated at the end of an existing rock-fill jetty, which extends 400 ft into the bay. Selection of the site was based on its central location relative to the base utility systems, proximity to a suitable on-shore site for a future power plant, and the fact that here the sea water (needed for condenser cooling) was uncontaminated by river silt and base sewage.

A water depth of 17 ft at mean low water permitted the ship to be floated into the basin at high tide without approach dredging. (The ship's draft varies from 14 to 20 ft.) Parallel alignment with the jetty was maintained so that prevailing winds would be off the ship's starboard bow, providing advantages in the design of the port-side mooring devices.

Dock construction

Since Thule's harbor is free of ice only a few months of the year, the use of floating construction equipment and barge transportation of materials is limited. For this reason, circular-cell construction was chosen for the dock structure and closure wall, to permit progressive construction with land-based equipment.

The dock consists of eleven steel sheetpiling cells 41 ft in diameter, spaced 47 ft on centers and connected by fillet cells of 13-ft radius. The sheetpiles, 45 ft long, were placed around a form and driven until their tops were about 6 ft above mean high water, then filled with rock and gravel. The upper 5 ft, being subject to seasonal freezing and thawing, was filled with non-frost-susceptible material to provide a suitable foundation for the utility lines and roadway along the dock surface. Below this depth, permafrost develops in the cells.

Construction began with the quarry-run rock-fill, extending from the end of the existing jetty to the site of the first cell, which was then placed, driven, and backfilled. Each successive cell was built in the same way and used as a platform for the construction of the next.

Even in June, Thule's arctic weather can be hazardous to construction. The first 10 cells and 9 fillet cells of the dock had been completed in November 1958 when harbor ice and freezing of the stockpiled fill finally curtailed construction. In late June 1959, construction was resumed with Cell 11. While the sheetpiles were being placed around the form, an on-shore wind drove the ice pack into the cell, badly damaging the form and temporarily delaying construction.

The closure section, consisting of four cells, was constructed after the ship had been towed into the basin. The closure section extends from the end of the dock to the end of the rock-fill section.

The quarry rock-fill was trucked to the site, dumped, and moved into place by bulldozer. Dredging of the sand and gravel bottom was done by equipment located on the dock and the rock-fill. Waste was dumped near the existing jetty, and on the harbor side of the rock-fill.

Circulation of sea water

Circulation of sea water through the basin is necessary to flush out bilge and sewage wastes, and to prevent overheating in summer as well as extensive ice formation in winter. Two openings are therefore provided in the dock—a discharge port for condenser cooling water, and an intake port aft of the ship to maintain the water level.

The discharge slot was formed by omitting the fillet cell between two cells. The roadway and utilities are carried over the slot on a concrete slab supported on 24-in. WF beams. To channel the discharge of condenser cooling water, sheetpile training walls, braced by wales, extend from the throat of the slot to within a few feet of the ship's hull. The training walls diverge from the ship to the throat of the slot. The narrowness of the slot (4 ft at the ship), plus the velocity and temperature of the discharge water, prevent large pieces of pack ice from entering.

The intake port—a reinforced concrete box having 36 sq ft of waterway—is located between two cells and just above the harbor floor. At this depth, there is little chance that ice will block the opening. The box was built by dewatering and bracing the fillet cell and then placing the concrete floor, wall, and roof slabs, which were tied to the adjacent sheetpiles by reinforcing rods welded to the piling. To develop adequate strength in the structure, high early strength concrete was used and warm air was pumped through temporary openings in the roof slab. The sheetpiling at the ends of the opening was cut off under water. Water temperature limited diving operations to very brief periods, considerably extending this phase of the work.

Suction for the ship's three pumps for condenser cooling water is taken

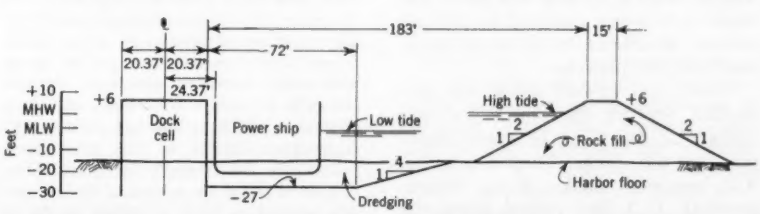


FIG. 1. Typical section of basin for docking power-plant ship near Thule, Greenland.

from a wet well extending the full width of the ship, having clear openings in the port and starboard sides for the entrance of sea water. Cooling water is discharged through three 24-in. pipes penetrating the hull below the water line. The entrainment of additional water by these submerged jets is such that the actual quantity of water being discharged from the basin is more than double that being pumped. Sufficient head differential is produced so that additional water flows into the basin through the intake port. This is the feature that produces the necessary circulation of water in the basin.

Land connections

An extensive ship-to-shore utility system is required so that the ship can receive fuel and water and deliver power and steam. Potable water from the base system is preheated at the base water-treatment plant and supplied to the ship through a 3-in., insulated and electrically heated pipeline. The mineral-insulated electric heating cables which trace the pipe are automatically energized when the water temperature in the line falls below 37 deg F. Water for boiler make-up is softened by the ship's zeolite treatment plant.

Steam extracted from the turbines and boilers is desuperheated, and exported at 85 psig and 530 deg F through five 8-in. steel pipelines that connect to a 20-in. header on the dock. This main extends to a second desuperheater station located at the end of the dock, where the steam temperature is further reduced to 400 deg F.

Necessary flexibility in each of the 8-in. ship-to-shore steam lines is provided by a system of five Barco ball joints designed specifically for steam of high pressure and temperature. Three ball joints of a different type are used on the fuel, water, and condensate return lines. Terminations of lines on the ship are supported on frames about 10 ft above main deck level. Terminations of lines on the dock are supported on a 21-ft structural-steel tower, secured to the bridge structure over the discharge slot.

All pipelines are insulated with 3 in. of foam glass, protected by a metal covering, and supported by timber sleepers placed on a gravel pad. The metal covering is required to prevent erosion of insulation by wind-driven sand and ice particles.

Power and control cables are suspended between the ship's port-side cable rack and a small tower structure on the dock. Three-conductor, 4/0, armored marine power cables, carrying 13.2 kw, extend from the tower to an onshore substation, and are carried on wooden sleepers along the dock and jetty.

A model of the project was built by the writer in conjunction with the development of the final design. All features of the installation were reproduced on a scale of 1 in. to 20 ft. Intake and discharge ports for condenser cooling water were duplicated in the model, and a miniature battery-powered centrifugal pump was installed in the ship's hull.

Constructed of waterproof materials, the model could be filled with water to actually duplicate the general flow pattern of circulating water. By introducing dye into the pump suction and placing floats in the basin and harbor portions of the model, the flow pattern was easily observed. The ship's intake and discharge ports could be partially or completely closed to simulate different operating conditions. Although not hydraulically to scale, the model confirmed design predictions and was useful in the preparation of certain operating instructions and the prediction of ice formation at the site.

The completed YFP-10 facility was successfully operated these past two winters by personnel of Burns & Roe Inc., of New York, N.Y. Several violent wind storms were experienced during the first winter without incident. The storms did however produce an interesting result, stripping all the thin ice off the surface of the basin and depositing some of it on the dock closure cells above the high-water level. This deposit was approximately 3 ft deep. During periods of extreme cold the basin was almost completely covered with a thin layer of ice. In milder winter weather, there was open water in the basin, which "steamed" even though its temperature was only 30 F.

The operation of the ship has also produced a small area of ice-free water in the harbor, which appears to be a popular winter resort for seals. It is not certain that this fringe benefit for arctic wild life was envisioned by the project planners.

Initial development and construction of the YFP-10 was by the Gibbs Corporation of Jacksonville, Fla., in conjunction with the Navy Bureau of Yards and Docks. Design for conversion and winterization of the ship for the Thule assignment was by Reynolds, Smith & Hills, Jacksonville, Fla. As noted, harbor design and mooring details were produced by Metcalf & Eddy, who also supervised the construction, done by Greenland Contractors of Trenton, N.J.

All design and construction activities for both the ship conversion and the berthing facilities were under the direction of the Corps of Engineers, U.S. Army District, Eastern Ocean, which was then commanded by Col. C. H. Whitesell, F. ASCE.

THE READERS WRITE

Shelters ARE sufficient for civilian protection

TO THE EDITOR: No one denies that many people will die if there is an atomic war. However, many will live. And many more can live if we engineers awaken to our obligation.

An atomic explosion is a localized explosion. Fully half the people in a city the size of Denver will be alive and well immediately after a direct hit on the city. And a direct hit is not a certainty even if a missile were aimed at Denver.

With what are we actually concerned? People and property directly under the blast, to a radius of about three miles, will disappear. No family shelter is adequate. The outskirts of most city target areas (from 3 to 5 miles from ground zero) will suffer extensive structural damage but most injuries will be from implosion of homes, flying glass and debris, and temperature burns. In this area many people will live through the attack. They can be saved if they have a shelter and are warned in time to utilize it. At 10 miles from the blast exposed people will receive a mild sunburn. Some windows will be broken.

Fallout is the only continuous danger and it reaches its peak probably three to four hours after the explosion. Many will die from it without adequate shelter. Only the foolhardy and the unindoctrinated will die with adequate shelters.

But what is an adequate shelter? Studies have predicted that a dosage of up to 200 units of radioactivity can be absorbed by the human body without appreciable damage. The intensity of fallout commonly used in shelter design is 500 units per hour. A person will probably eventually die if he is completely unsheltered for one hour during peak fallout activity.

Shelter design must be predicated on the time the radioactivity takes to decay. A normal bomb will cause fallout that will drop to below a dangerous level in two days. If a person can withstand a total accumulation of, say, 240 units, then the average rate of absorption must be 10 units per hour maximum. If the average

outside intensity is 100 units per hour (recall that the peak is 500) then the shelter must allow passage of no more than 10 percent of the activity. Many basements with the windows bricked up will provide this much protection.

Since dangerous exposure does not start for some time after an explosion, a family will have at least half an hour before the fallout reaches serious proportions. There will be time to move calmly to the shelter, collecting the necessary food and water on the way. In addition, recall that fallout dissipates quickly. Within two or three days the intensity is so low that normal regenerative functions of the body will keep pace with the detrimental effects.

It is indeed unfortunate that movies and fanatic science fiction books have so frightened the people that they have given up without a fight. We must fight! We must tell the people that they will have time to use shelters, that food stuffs in cans on open shelves are still uncontaminated, that water need only be filtered to be drinkable, that many existing homes are already adequate shelters, that shelters are often inexpensive revisions to the homes they now own.

The Russians already have their shelters. They will live. Will we? We can!

ALBERT KNOTT, A.M. ASCE
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University of Colorado

Boulder, Colo.

Unsymmetrical X-bracing detailed by simple method

TO THE EDITOR: In structural steel detailing, X-bracing may be unsymmetrical for one reason or another. The following method is suggested for the detailing of such bracing. Other formulas are available but the one I have derived does not to my knowledge appear in textbooks. It is,

$$D = \frac{C}{\tan a + \tan b}$$

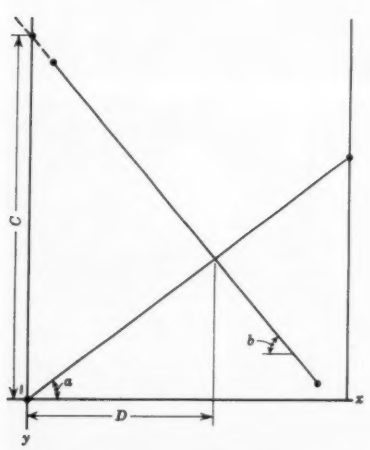

FIG. 1. Unsymmetrical X-bracing.

The notation is defined in Fig. 1.

To make the problem clearer, all given dimensions and work points have been omitted. Also, it is assumed that the y-axis always passes through the work point of the diagonal, as shown.

Angles a and b are first calculated from given data. Once the value of D has been determined, all the other necessary dimensions are readily found.

S. L. KRECHEFSKY

Kansas City, Mo.

EDITOR'S NOTE: *Because of a misprint in the equation in this letter as it appeared in the May issue, p. 76, the letter is here reprinted correctly.*

Competent surveying costs money but is worth it

TO THE EDITOR: I agree with Mr. Fennell, in his article in the April issue, "Surveying—Its Current Status in Civil Engineering," that surveyors require training but I disagree with his statement that "Land surveyors probably fear that civil engineers are trying to usurp their jobs." What a great many really fear is that if the colleges turn out enough really educated and conscientious surveyors, the buying public may wake up to the fact that competent surveying costs real money and that you can't buy a survey on a lump-sum bid. The good surveyors won't bid and the lantern-boys (part-time) will cut the survey to fit the bid.

There are hosts of pseudo-surveyors who work for almost nothing and deliver less than nothing. Many are able to operate only because of the cupidity of their clients. On the other hand there are few, but still enough, competent and honest surveyors who can be trusted to furnish accurate plans provided the owner is willing to foot the bill and cooperate with the surveyor as his work progresses. A good survey requires time; corps and draftsmen have to be paid. If an owner is unwilling to pay, he is better off with no survey than with one from a cut-rate lantern-man.

The buyer or owner is really the responsible party. It is his land and he knows, or should know, how far he should go in making a permanent record of landmarks that will be erased by construction activities. A mere perimeter survey, even if monumented, is useful as evidence in court only to the extent that the jury believes in the competence of the surveyor, and even that is lost if the surveyor is no longer available. But if the time and money are spent to locate and put on the plan all old landmarks, old fences, roads, etc., a contender against the owner, even more so after the passage of years, will have difficulty in disproving the records.

The buyer must check the survey as far as he can. When the surveyor knows that his client will check every possible detail, he will not cut corners. Good surveyors will be pleased to have the buyer's cooperation.

JOHN ORTH COOK, F. ASCE
Consulting Engineer-Geologist
Sewickley, Pa.

Surveyors should recognize the work of technicians

TO THE EDITOR: In his article, "Surveying—Its Current Status in Civil Engineering" (April issue, p. 33), Mr. Fennell has given an excellent summary of what has become an unnecessarily confused subject. Here in Kansas it is a timely subject because we have just passed through a legislative session in which a proposed bill to create a separate license or registration for surveyors was defeated largely through the overwhelming opposition of the licensed professional engineers. The bill was introduced by a group of the land surveyors' society who stated flatly that they wanted no help from the engineers and would have no part in any joint endeavor.

Most of the engineers felt that, in this state, land surveying should be regulated by writing it into the Professional Engineering Act as a specific part of professional engineering practice. This may seem unacceptable to surveyors, and engineers too, in states where the two have developed practically as separate professions, but in this state it is the only really good solution.

Mr. Fennell touches on a point that has not had the attention it deserves from engineers generally. While the man in responsible charge must be a professional engineer, a large part of the work, perhaps even most of it, can be performed by skilled technicians, starting with the instrumentman, who is the actual "surveyor." This points not only to the need for specific training, but what is more important, for some means of qualifying or certifying the technician and giving him proper recognition.

NSPE has already taken some well studied action in this field, and it is to be hoped that ASCE will recognize the importance of this step. The function, and the status, of the technician is one of the key points to be considered in assigning to the engineer the professional responsibility for organizing and directing survey work, whether it be staking out a city lot or mapping half a continent. Engineers are long overdue in recognizing, as the medical profession long since did, the specific role of the technician and the need for formal recognition of it.

Much ado has been made about the very special local knowledge and experience required to handle land surveying, which supposedly can't be taught in engineering courses. It has been our observation that the basic principles of land subdivision are—or certainly can be—taught in any good beginning survey course. The great majority of what pass for deeply complicated problems in surveying call for exactly the same kind of professional judgment required to solve any other engineering problem.

In conclusion it is heartening to see the civil engineering branch of the profession finally waking up to the importance of the work of the lowly surveyor—who, after all, was the original civil engineer.

R. S. DELAMATER, F. ASCE
Consulting Engineer
Wichita, Kans.

Let's "sell" our profession to the high school student

TO THE EDITOR: President Holcomb, in his speech at the Phoenix Convention (May issue, p. 33) has clearly epitomized the issue on which the future of our profession rests when he states that "the strength of the profession always depends on the young people who come into it each year." Hence we should all be deeply concerned with the recent decreases in quantity, and above all in quality, in undergraduate civil engineering enrollments.

To reverse this dismal trend the demands that our courses make on the student must be increased rather than decreased. The student should be shown that as exciting, fundamental and far-reaching studies are conducted in civil engineering as in other scientific areas. He should want to become a member of the civil engineering profession not because it is easier or pays better, but because it is the broadest, most basic of all the engineering professions and by far the most demanding. It requires scientific excellence combined with a deep sense of purpose and social responsibility.

If there has been an inspirational failure, I believe it has occurred at the pre-college level. It is here that we must exert our greatest efforts to win the eager minds of this most idealistic segment of our population, that is, the high school student.

We can do this only by attracting the very best intellects, by slanting our curricula not only toward our immediate needs but also toward those of 20 to 50 years from now, by refusing to believe that the demands of our profession can be met by a sprinkle of first-rate talent surrounded by a limbo of mediocrity. There is enough talent among the high school youth of the country to ensure our success in such an effort.

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Pittsburgh, Pa.

Fluid mechanics in stilling-pool design

TO THE EDITOR: The excellent article, "Fluid Mechanics—Its Scope and Challenge" (May issue, p. 62), included photographs to illustrate the application of fluid mechanics principles. The author, Prof. George Bugliarello, stated, "If the Tacoma Narrows Bridge is a dramatic reminder, there are many less publicized cases in which neglect of fluid mechanics factors has resulted in inadequacies, failures, or expensive overdesign."

The photograph of the drop and stilling pool at the bottom of page 62 illustrates this statement and also answers the often asked question, "Why are not trapezoidal stilling pools used more extensively?" Using the photo as the only source of information, it is evident that the flow has failed to expand sufficiently after entering the pool to fill the cross-sectional area. A high-velocity current has formed along one wall and a return eddy along the other. For larger discharges the pool will perform in the same general manner, resulting in waves and currents which, in most installations, could damage the downstream channel.

In designing this basin the principle that high-velocity flow can diverge only at a certain rate was lost sight of in the desire to produce a downstream flow area large enough to provide a low exit velocity. A basin with less divergent walls, tailored to fit the characteristics of the incoming jet, would have provided more satisfactory stilling action and might have resulted in a smaller basin. However, the trapezoidal cross-section also tends to produce instability in that it is usually impossible to fill the edges of the cross section sufficiently to produce uniform flow. Vertical walls, therefore, would also improve the performance of the basin.

Hydraulic models have demonstrated that basins of this type are inherently unstable. The "white water" current can be "switched" to the other side of the basin at will by forcing the jet with a board or shingle. Depending on other conditions, the flow may remain where fixed or it may return to the original position. In no case, however, is it possible to center the flow in the basin. Proper attention to the fluid mechanics aspects of the problem would have resulted in a more efficient stilling basin, and perhaps a less costly one.

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Hydraulic Engr., U.S. Bur. of Reclamation

Denver, Colo.

EDITOR'S NOTE: *The pictures used with Professor Bugliarello's article were from* CIVIL ENGINEERING *files, selected by the editors rather than the author.*

"Tension coefficient" method further simplified

TO THE EDITOR: The method of "tension coefficients" developed by Müller-Breslau and Southwell is clearly restated and elegantly exemplified by Joseph W. Fortey and Nat W. Krahl in their article, "Stress Analysis of Space Frames" (February 1961 issue, pp. 60-61).

In the accompanying Table I, the writer has further simplified the method by merely rearranging the mathematical system so as to make the entire solution progressively self-evident.

With still another rearrangement (avoiding a zero element on the main diagonal, if the process involves division by any such element), a general 15 x 15 (or more) matrix solution can be applied. However, the time of execution would be increased unless both program and computer were available, and the computation error would grow in the order of $3n/10$ figures lost, n being the number of simultaneous equations in the set. Statistically, in general, for a set of 15 equations, it would be necessary to carry the results to eight significant figures in order to insure accuracy to three significant figures.

An examination of the mathematical system formulated for a physical system usually suggests pertinent short-cuts conducive to precision. The foregoing discussion elucidates such a case, extends the simplicity of the Fortey-Krahl presentation, and checks their solution exactly.

SHU-T'IEN LI, F. ASCE
Consulting Engr., Formerly Dean, College of Eng., Peiyang Univ.

Mobile, Ala.

TABLE I. Rearrangement of mathematical system for method of "tension coefficients"

MATRIX ELEMENTS		UNKNOWN TENSION COEFFICIENTS															CONSTANTS	SOLUTION	HINTS
		a	*b*	*c*	*d*	*e*	*f*	*g*	*h*	*j*	*k*	*l*	*m*	*n*	*p*	*q*			
•	†	↘																	
A2	1	−1	1					(All zero elements left blank)									−1	$b = 1/4$	(2)−(1)
A3	2	1	1														−1/2	$c = -3/4$	
A1	3	1															$-4(b+c)/7$	$a = 2/7$	
B1	4				1	1											$-7a/3 = -2/3$	$d = -1/3$	(4)+(5)
B2	5				1	−1											0	$e = -1/3$	
B3	6						1										$-(d+e)$	$f = 2/3$	
C3	7															1	f	$q = 2/3$	
C1	8							1	1								0	$g = 0$	Unique
C2	9							1	−1								0	$h = 0$	
E1	10										1			−1			$(3d-4e)/3 = 2/3$	$k = -5/24$	(10)+(11)
E3	11										1			1			$c+d = -13/12$	$n = -7/8$	
E2	12									1							$(k-c-d-n)/2$	$j = 7/8$	
D1	13											1	1		−1		$(3e-4b)/3 = -2/3$	$l = -7/12$	(13)+(14)
D2	14											3	−1		1		$-(b+e+2j) = -5/3$	$m = 5/24$	Last
D3	15											1	1		1		$b+e = -1/12$	$p = 7/24$	(15)−(13)
		a	*b*	*c*	*d*	*e*	*f*	*g*	*h*	*j*	*k*	*l*	*m*	*n*	*p*	*q*			

* Original author's equation sequence. † Rearranged, transposed equation numbers.

Construction shortcut in forming sidewalls

Contractors for the huge Central Intelligence Agency Building now under construction at McLean, Va., recently came up with an idea for forming the vertical planes of weakness in the concrete sidewalls that soon led to measurably improved work schedules. In brief, these contractors, C. H. Tompkins and J. A. Jones, adopted a product used to form contraction joints in highways, turned it on end and applied it to building construction.

Other than the idea, all that is needed is a plastic joint former made by American Sisalkraft Company, Division of the St. Regis Paper Company, plus a little ingenuity to apply it in a vertical plane.

The joint former consists of two pieces—a vinyl plastic envelope or V-section 2 or 3 in. deep, and a T-strip, also of vinyl plastic, that is inserted in the top of the envelope. See Fig. 1. The envelope is nailed to the edge of a wooden form. One edge of the envelope is notched about every 12 in. and nails are driven through the opposite edge at these points. The wooden form is then erected and the T-shaped spreader inserted in the envelope.

Below: V-shaped envelope is nailed to edge of form. Left: Form is in place with envelope along near edge. Notches on outer edge of envelope (retouched) permit nailing of inner edge to the form. The T-shaped spreader bar is not yet in place.

Form easily removed

When the form is to be removed the T-shaped spreader bar is freed from the envelope, which then collapses, and the form is pulled away leaving a clean line in the wall.

Considerable time is saved over previous methods where thin slats were used in place of the joint former. These often splintered and had to be dug out of the joint. Alignment has also been improved; workmen simply move the T-shaped spreader bar from one strip up or down to engage a portion of an adjacent envelope. The vinyl envelope, being reusable, is left on the wood form for the next pour.

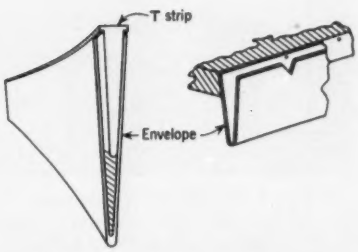


FIG. 1. Vinyl plastic joint former consists of two pieces, envelope and T-strip spreader bar.

ASCE NEWS

Airport Capacity Studied at Third Air Transport Division Conference

It was just four years ago that the Air Transport Division of ASCE held its first national "Jet-Age" Airport Conference. The contrast between the subjects discussed at that conference and those studied during the most recent conference is striking. In 1957, engineers were describing the facilities which had to be provided if the proposed jet aircraft could be operated commercially.

Now, only four years later, jet operations are so common that the men planning ahead for air transport facilities have shifted their attention to the study of facilities needed for supersonic and aero-space vehicles. Another shift apparent is the increasing attention being given to the relationship of the airport to the community. For, in the short space of four years, some of the major airports have become cities in themselves, affecting the economic well being of the communities they serve.

The year's Airport Conference was a joint venture of the Airport Operators Council and the Air Transport Division of ASCE, meeting for mutual discussion of the theme, "Increasing Airport Capacity." The associated meetings were held in Miami Beach, May 8-12.

To focus on the extent of planning needed for increased airport capacity, George DeMent, commissioner of the Chicago Department of Public Works, quoted some estimates issued on the basis of studies made by the Federal Aviation Agency. These describe well over $1 billion worth of airport development needed in the next five years. Such an estimate is based on a plan to provide a national system of airports, providing 20 new air commerce airports, about 400 general aviation airports, and 75 new heliports. Commissioner DeMent then pointed out the "obvious requirement for individual airport master plans based on logical and expected growth." He proceeded with a system for developing such master plans. Stripped to its bare essentials, "this involves: (1) A comparison of capacity of the present airport or airport system with forecast traffic; (2) if necessary, the increase of capacity of present airports by all known technological means; (3) if present airports even at their ultimate capacity, cannot handle forecast traffic, preparing for the eventuality of an additional airport or airports."

The details of his proposals, as well as all other conference papers, will be carried in the Proceedings of the Airport Conference, which will be available at an early date.

Because of the nature of air transport, local or community airports frequently just don't suit the pattern of traffic. This leads to recognition of the importance of regional airport planning, a subject covered very thoroughly by Ray O. Kusche, F. ASCE, president of Quinton Engineers, of Los Angeles. With the tendency of urban communities to be grouped in regions, there is the problem of overlapping areas of political influence or jurisdiction. The result, in a few cases cited by Mr. Kusche, has been the establishment of major airports within such close proximity that they actually compete for service areas and air space.

He recommended "the development of a plan for regional airport systems to avoid the creation of separate airports by individual jurisdictions which could result in inconvenience to those requiring air transportation, if not coordinated." Coupled with this, he said, "there is an obvious need for a comprehensive airport plan and paralleling action programs in many urban areas which should be coordinated with all other aspects of land use planning." Pertinent to such studies is the consideration of the access problem. As an example, Mr. Kusche called attention to the ground transportation problem at Los Angeles, "for if 7,000,000 passengers travel an average of 30 miles each trip, this is over 200,000,000 access miles a year."

The type and capacity of airport facilities provided has been determined largely by the development of new aircraft. As mentioned earlier,

Conference procedures are discussed by Ross Knight, of the Airport Operators Council, with program participants Thomas Sullivan, of Port of New York Authority; Ray Kusche, consulting engineer of Los Angeles; and Reginald Sutherland, of American Airlines, representing the Executive Committee of the ASCE Air Transport Division.

General Chairman Robert Horonjeff (second from left), points to a highlight of the program. William M. Beadle, chairman of the Program Committee, is at Mr. Horonjeff's left, and Carl H. Peterson, Local Arrangements chairman for the conference, and Walter Dinn, president of the ASCE South Florida Section, to his right.

the first conferences held by the Air Transport Division had the specific objective of trying to encourage the provision of airport facilities which could handle the jet aircraft that were even then on order. While some still believe that the aircraft put into use should accommodate itself to airport facilities, this did not seem to be a tenable position to many of those attending the Miami Beach conference. Instead, they spent much time discussing the nature of the air, or aerospace vehicles to come. A rather detailed report was presented to the conference by Reginald J. Sutherland, F. ASCE, of American Airlines, who attended the technical conference of the International Air Transport Association, held in Montreal last April.

From the Montreal meeting, Mr. Sutherland brought some indication of the vehicle that must be considered by airport operators and engineers in the very near future. Such aircraft will have speeds of Mach 2 to 3 (1,400-2,200 mph), will weigh between 200,000 and 450,000 lb, will have a range of about 3,500 miles, and will carry from 75 to 175 passengers.

It was encouraging to hear that studies presented by various manufacturers indicated "that take-off, climb and descent, and landing speed characteristics would be generally similar to our current jets with some slight variations." Some of the biggest problems faced are in the provision of runways. It appears that some equivalent "single wheel loadings as high as 120,000 lb are possible." It is probable that much more serious problems will be faced in the matter of runway pavement and smoothness and such things as slush on the runways. Apparently both bumps on the runway and slush or even water in puddles would be pretty serious to the take-off of the supersonic craft.

There was some indication that current runway lengths and widths would be adequate for the aircraft now on the design board, but that more attention would have to be given to turn-offs and taxiways.

Luncheon speakers capture attention

Although engineers are frequently accused of selecting only engineers to speak to engineers, this certainly was not the case in Miami Beach. Luncheon speakers included Federal Aviation Administrator Nageeb E. Halaby; Wayne Parrish, the president of American Aviation publications; and Jerome F. Lederer, managing director of Flight Safety Foundation. The viewpoints presented on the challenges before the air transport industry, and the necessary restraints of public service, proved stimulating. Administrator Halaby described the concept of national aviation systems, of which the individual airport is a unit. The "systems" approach is an important consideration in current airport planning.

Very interesting sessions were conducted by the Airport Operators Council, preceding the opening of the joint sessions. Some of these were for members of the Council only. Others were open to all attending. A new AOC president was elected, Herbert C. Godfrey, Jr., director of the Tampa (Fla.) Aviation Authority.

Facilitating the excellent local arrangements were Carl H. Peterson, F. ASCE, and George L. Smith. Both men are in the Miami office of Howard-Needles-Tammen & Bergendoff.

Group Insurance Program for ASCE Members Changed

At its Phoenix meeting the ASCE Board of Direction approved several changes in the Group Insurance Program for Members. The various changes approved—all of them in the interest of providing increased coverage—will be explained in detail in a July mailing to members participating in the Society's insurance program. Changes in two plans approved by the Board—for claims incurred on or after August 1, 1961—are described briefly here.

The Disability Income Protection Plan

In consideration of favorable claims experience, the Continental Casualty Company has agreed to add the following benefits to coverage under the Disability Income Protection Plan without any increase in cost:

1. Double the amount of weekly indemnity will be paid, during a period of hospital confinement of up to 90 days, on claims incurred prior to the insured's 60th birthday.

2. Payment of 50 percent of the weekly indemnity, up to four weeks, for partial disability due to sickness which follows a period of total disability due to sickness.

The Major Hospital-Nurse-Surgical Plan

The ever-increasing costs of institutional medical care necessitate changes in insurance coverage if the practical application of the insurance is to be maintained. These changes require changes in the contract itself, either increasing the costs, or having the insured member himself pay small medical bills.

After extended study and negotiation, the Company has agreed to increase the coverage, leaving the premium level as it has been since the plan was originally approved, provided the member himself pays for the first $75 of hospital care. In exchange for this deductible amount, the following increase in benefits will be extended:

1. Increase the maximum limit of payment from $5,000 to $10,000.

2. Increase the present $15 a day maximum for hospital room and board expense to $20 a day.

3. Add an allowance of up to $50 for emergency out-patient expense for treatment or service by a doctor or hospital within 24 hours of an accident.

4. Increase the amount allowed under the surgical schedule by 50 percent, when a pathologically diagnosed cancer condition (other than leukemia) is directly involved.

5. Increase the maximum amount payable for mental condition from $1,500 to $2,000.

6. Increase the maximum age to which unmarried dependent children may be covered under the policy from 19 to 21; or to 25, if the child is in full-time attendance at a college or university.

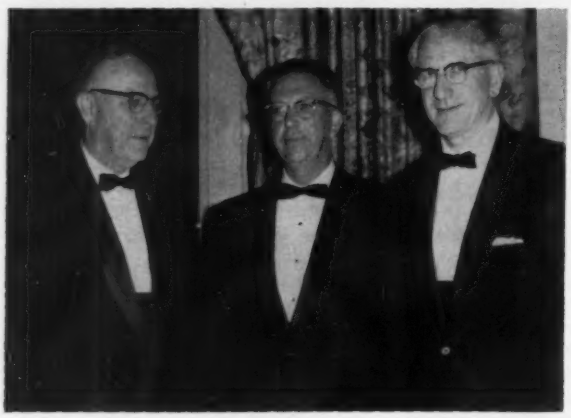
The $75 deductible amount will not apply to the surgical schedule or to the new $50 emergency accident benefit noted above.

An additional option has also been provided for the Major Hospital-Nurse-Surgical Plan, that is, a $500 deductible policy with much lower costs. This option might be chosen by members who wish to supplement basic coverage they are now carrying, such as Blue Cross.

ASCE Membership as of June 9, 1961

Fellows	11,135
Members	16,763
Associate Members	19,409
Affiliate Members	118
Honorary Members	51
Total	47,476
(June 9, 1960	45,526)

Engineer Presidents at CEC Conference



Presidents of three engineering societies compare notes at the fifth annual meeting of the Consulting Engineers Council, held in Chicago in May. They are (left to right) ASCE President Glenn W. Holcomb; Harold P. King, F. ASCE, newly elected president of the Council; and Gerald T. McCarthy, F. ASCE, president of the American Institute of Consulting Engineers. Presidents Holcomb and McCarthy were guests of honor. Acceptance of an application for membership from the Practicing Engineers and Land Surveyors of Wyoming brings to 32 the number of associations formally affiliated with the Council.

ASCE ENGINEERING SALARY INDEX

(Prepared Semiannually)

Consulting Firms

CITY	CURRENT	PREVIOUS
Atlanta	1.38	1.21
Baltimore	1.14	1.14
Boston	1.23	1.23
Chicago	1.50	1.49
Denver	1.25	1.25
Houston	1.26	1.26
Kansas City	1.19	1.15
Los Angeles	1.35	1.32
Miami	1.38	1.38
New Orleans	1.22	1.22
New York	1.29	1.29
Pittsburgh	1.07	1.07
Portland (Ore.)	1.28	1.24
San Francisco	1.35	1.34
Seattle	1.13	1.06

Highway Departments

REGION	CURRENT	PREVIOUS
I, New England	1.03	1.03
II, Mid Atlantic	1.15	1.15
III, Mid West	1.26	1.29
IV, South	1.12	1.12
V, West	1.13	1.16
VI, Far West	1.16	1.17

Sole purpose of this Index is to show salary trends. It is not a recommended salary scale. Nor is it intended as a precise measure of salary changes. The Index is computed by dividing the current total of base entrance salaries for ASCE Grades I, II, and III by an arbitrary base. The base used is $15,930, the total of salaries paid in 1956 for Federal Grades GS5, GS7 and GS9. Index figures are adjusted semiannually and published monthly in CIVIL ENGINEERING. Latest survey was December 31, 1960.

Spokane Section Host to Pacific Northwest Council

Success—technical and social—of the annual three-day meeting of the Pacific Northwest Council, held in Spokane, April 20-22, is reported by the host (Spokane) Section. Over 150 engineers and many wives attended the meeting from the following Sections; Montana, Spokane, Columbia, Seattle, Alaska, Oregon, Tacoma, and Southern Idaho. Among many distinguished speakers were: N.B. Bennett Jr., assistant commissioner for power and general engineering, U.S. Bureau of Reclamation, Washington, D.C.; H.R. Wessman, dean of engineering, University of Washington; and W. I. Robertson, principal bridge engineer, Washington State Department of Highways, Olympia.

The first day was devoted to a wide range of Local Section business. The general program began on the second day, with briefing sessions on the three technical sessions which were held concurrently on the last day. These three programs were: Sanitary and Hydraulics, Urban Renewal Structures, and Missile Base Construction. The technical sessions also featured field trips to swimming pools, sites for urban renewal, St. Charles Church (with the largest single hyperbolic paraboloid roof), and to the Atlas Missile base at Deer Park.

Social events for the ladies included a luncheon, a comedy, and a tour of Cheney Cowles Museum. Nearly 200 attended the Buffalo Barbecue in Western garb. In true Western tradition the buffalo was hunted and shot, but not with an old-fashioned buffalo gun. Dinner featured barbecued buffalo and salmon, and "Buffalo chips" (huge gingerbread cookies). Each Section presented a skit. First place was won by the Whistling Midgets. The prize? Five pounds of "buffalo chips."

Newly elected officers for the Pacific Northwest Council are: John P. Esvelt, president; Prof. Richard Meese, vice president; and Wilho E. Williams, secretary-treasurer. Karl O. Strenge was chairman of the Committee on Arrangements.

Seen at Spokane meeting of the Pacific Northwest Council are, in usual order, John Esvelt, incoming Council president; Newcomb D. Bennett; John Mangan, president of the Spokane Section; and Harold F. Sitts, retiring Council president.

Iowa Section Host to District 16 Council

The Iowa Section was host to a number of Society groups that met in Des Moines early in May. The series of meetings started May 3, with an all-day meeting of the District 16 Council. On May 4 and 5 there was a Society-sponsored Local Section Conference. The Technical Procedure Committee was also in session on May 5, meeting with the Iowa Section later that evening. Finally, on May 6, there was an all-day meeting of the ASCE Committee on Division Activities.

Photo at left shows (in usual order) William R. Gibbs, of Kansas City, Mo., 1960-1961 chairman of the District 16 Council; Merwin Dougal, of Des Moines, newly elected Council chairman (for 1961-1962); and ASCE Director N. T. Veatch, who is also a director of the Council.

Society and Section officials seen at Des Moines are (left to right) E. R. Baumann, of Ames, president of the Iowa Section; ASCE Vice Presidents William J. Hedley, of St. Louis, and Charles B. Molineaux, of New York; ASCE Executive Secretary W. H. Wisely, of New York; and ASCE Director N. T. Veatch, of Kansas City, Mo.

Designing Structures to Resist Nuclear Blast

Availability of "Design of Structures to Resist Nuclear Weapons Effects," the most recent in the series of ASCE Manuals of Engineering Practice, is announced. Identified as Manual No. 42, this work of the Engineering Mechanics Division, through its Manual Subcommittee, has been in preparation for several years. It was written for the use of the engineering profession in the design of structures intended to be resistant, in some degree, to all the effects associated with the detonation of a nuclear weapon.

Manual No. 42 may be obtained by use of the coupon on page 101. The list price of the paper-bound publication is $4.00, with members entitled to a 50 percent discount.

ASCE Committee Studies Local Section Policy

Policy on the formation of new Local Sections and Branches of the Society was discussed at considerable length at a meeting of the ASCE Committee on Local Sections, held in Dallas, Tex., May 26 and 27.

It is the opinion of the committee that existing political or economic units represented by existing Local Sections should not be divided unless the proposed new Section includes in its area an entire state. The committee also feels that, in many ways, statewide Sections offer greater benefits to members than may otherwise be obtained. As a guide for the establishment of new Branches of existing Local Sections, the committee has formulated the following policy:

1. A proposed Branch must have distinct boundaries.

2. A petition containing a minimum of fifteen signatures of Society members resident in the area should be submitted to the Society by way of the Local Section.

3. The proposed Branch area should contain a minimum potential of 25 members of the Society.

4. Those proposing a new Branch should demonstrate in writing how it will be of real benefit to members in the area to have a Branch.

As indicated, these are guides. The committee has Section- and Branch-formation policy under constant review.

John P. Hogan, ASCE Past President, Dies

John Philip Hogan, Past President of ASCE and retired New York City consultant, died on June 9 in Santa Barbara, Calif., where he had lived for the past five years. He was on the eve of his 80th birthday. Prominently identified with many important New York City projects, Mr. Hogan was acting deputy chief engineer for the Catskill water supply project and aided in the design of Schoharie and Ashokan Dams and 27 miles of aqueduct for the city supply system. He was also chief engineer and later vice president of the New York World's Fair.

A graduate of Harvard, Mr. Hogan began his career in 1904 as an engineer for the New York City Rapid Transit Commission. From 1926 until his retirement in 1947, he was a partner in the New York City consulting firm of Parsons, Brinckerhoff, Hogan & MacDonald. After his retirement he became a consultant to the successor firm of Parsons, Brinckerhoff, Quade & Douglas. Mr. Hogan was consultant to the Corps of Engineers on the construction of Bonneville Dam on the Columbia River and other important multi-purpose water projects. Just before his retirement he was a member of the New York City board charged with selecting and developing the site for the United Nations Headquarters.

Mr. Hogan served the Society in many capacities, including terms as Director, Vice President, and President (1940). He had also been president of the Society of American Military Engineers.

Pictured at an executive committee meeting of the newly formed Group are (left to right) James L. Sherard and William S. Kapp, directors; James D. Parsons, chairman; Charles R. Heidengren, secretary-treasurer; and Robert E. White, vice chairman. Director Stephen T. Mikochik was not present. ▼

Metropolitan Section Forms Soil Mechanics Group

The Metropolitan Section has established a Foundation and Soils Mechanics Group, which will work closely with the Section, especially in areas involving soil mechanics and foundation engineering.

Enrolled members of the Metropolitan Section who are interested in soil mechanics and foundation engineering are cordially invited to take part in the activities of the Group. Meetings will be held bi-monthly.

UNESCO Seeks Highly Special Engineer Group

The United Nations Educational, Scientific and Cultural Organization is seeking a limited number of highly specialized engineers for field assignments in Asia, Latin America and Africa. Engineers Joint Council's Committee on International Relations, which works closely with UNESCO and the U. S. State Department in matters affecting the engineering profession internationally, brings this to the attention of the profession in the spring issue of its publication, *Engineer*.

EJC's Committee on International Relations points out that the United Nations is also seeking practical engineers for the same areas, in addition to the specialized engineering educators UNESCO needs. Information on the requirements of UNESCO may be obtained from Paul R. Serey, Staffing Management Officer, Office of International Administration, Room 5327, Department of State, Washington 25, D.C.

SOCIETY AWARDS AND FELLOWSHIPS AVAILABLE

DANIEL W. MEAD PRIZES:	*1961 contest closed June 1, 1961.*
FREEMAN FELLOWSHIP:	*1961 contest closed. New contest opens. See Official Register, page 158.*
J. WALDO SMITH HYDRAULIC FELLOWSHIP:	*1961-62 contest closed. No 1962-63 contest offered.*
RESEARCH FELLOWSHIP:	*1961 contest closed. New contest closes Jan. 1, 1962.*

LOCAL SECTION MEETINGS

Arizona—Arizona Regional Meeting held jointly with the American Congress on Surveying Mapping at the Westward Ho Hotel, Phoenix, October 18-21.

Cleveland—Annual picnic at Euclid Park Clubhouse, E. 222 Street on the shore of Lake Erie, on Friday, July 21. Buffet supper at 6:30 p.m.

Illinois Section—Weekly luncheon meetings at the Chicago Engineers Club (314 South Federal Street), every Friday at 12 noon.

Massachusetts—Three summer luncheon meetings at the Hotel Lenox, Boston, on July 19, August 16, and September 21, at 12:15 p.m.

Sacramento—Weekly luncheon meetings at the Elks Temple every Tuesday, at 12 noon.

St. Louis—Regular monthly luncheon meetings at the York Hotel on the fourth Monday of each month, at 12:15 p.m.

TECHNICAL DIVISION MEETINGS

HYDRAULICS DIVISION CONFERENCE

Urbana, Ill.
University of Illinois
August 16-18, 1961
Sponsored by
Hydraulics Division

WEST COAST CONFERENCE OF APPLIED MECHANICS

Seattle, Wash.
University of Washington
August 28-30, 1961
Co-sponsors
Engineering Mechanics Division
ASME

CONFERENCE ON FUNDAMENTAL RESEARCH IN PLAIN CONCRETE

Monticello, Ill.
University of Illinois
September 5 and 6, 1961
Co-sponsor
Structural Division

AMERICAN ASSOCIATION OF PORT AUTHORITIES CONVENTION

Long Beach, Calif.
September 25-29, 1961
Sponsor
Waterways & Harbors Division

ASCE CONVENTIONS

ANNUAL CONVENTION

New York, N. Y.
Hotel Statler
October 16-20, 1961

HOUSTON CONVENTION

Houston, Tex.
Hotel Shamrock
February 19-23, 1962

OMAHA CONVENTION

Omaha, Nebr.
Hotel Sheraton-Fontenelle
May 14-18, 1962

DISTRICT CONFERENCES

DISTRICT 7 COUNCIL

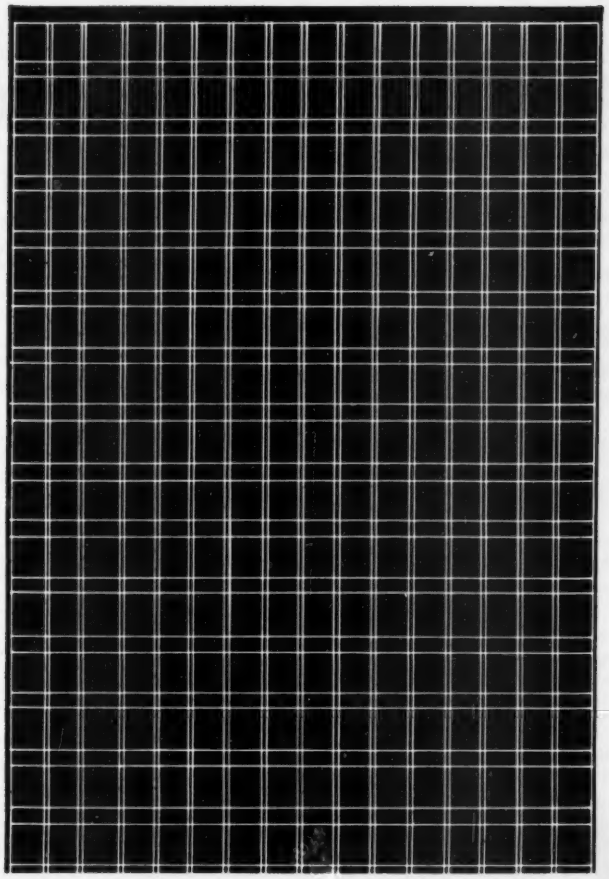
Milwaukee, Wis.
August 11 and 12, 1961

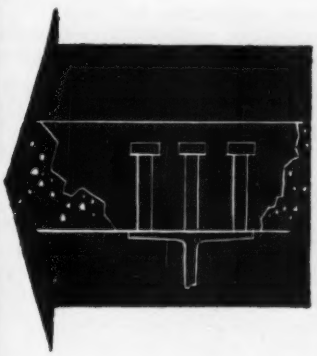
DISTRICT 9 COUNCIL

Mammoth Cave, Ky.
September 9 and 10, 1961

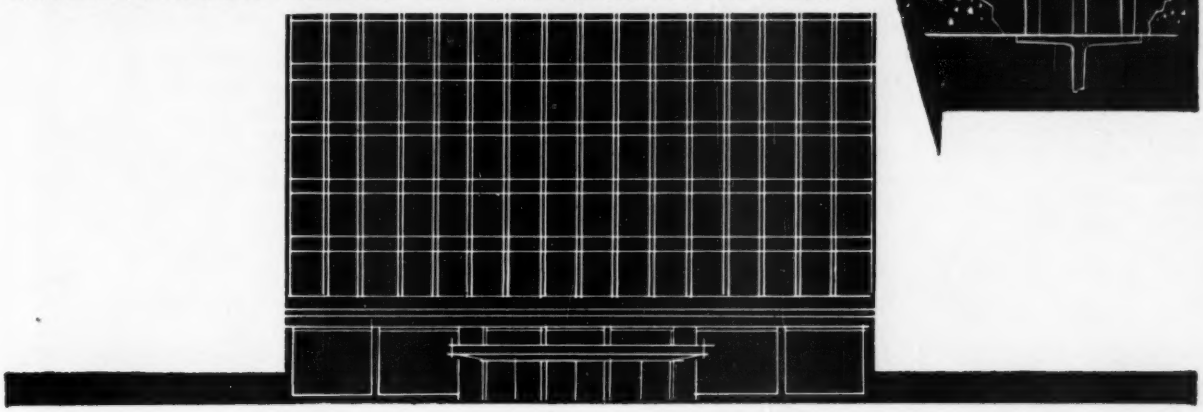
DISTRICT 4 COUNCIL

Harrisburg, Pa.
October 7, 1961





SEVENTH FLOOR "BEEFED UP" WITH COMPOSITE DESIGN



Problem: How to make the seventh floor of the existing 22-story Texas Eastern Building (formerly the First City National Bank Building) in Houston strong enough to carry massive electronic computing equipment, with minimum disturbance to present tenants. Structural Engineer Arnoldo Longoria of H. E. Bovay, Jr., Consulting Engineers, considered several possible answers before coming up with the one really practical solution—composite design using NELSON studs as shear connectors. By using this economical construction technique, the total floor loadings were increased from 125 to 225 p.s.f. The composite design approach resulted in a clear floor for easy installation of the false floor and conduit. Existing floor-to-ceiling height was not reduced, and duct work for the ventilating requirements remained unaltered. For full information on the many advantages offered by the use of composite construction in new and existing buildings, write: NELSON STUD WELDING, Division of Gregory Industries, Inc., Dept. 10, Lorain, Ohio.

GREGORY INDUSTRIES

THE YOUNGER VIEWPOINT

Committee on Younger Member Publications

Walter D. Linzing, Chairman; 4751 No. Paulina, Chicago 40, Ill.

Zone I	Zone II	Zone III	Zone IV
Donald Kowtko 289 Foxhill Road Denville, N. J.	Albert C. Nelson 250 N.E. 51st Street Miami, Fla.	William R. Walker 4600 Franklin Ave. Western Springs, Ill.	Judd Hull 6000 S. Boyle Ave. Vernon, Calif.

This month's contributing editor is Walter D. Linzing, chairman of the Committee on Younger Member Publications.

Strengthening the profession

The following interesting letter was received from a young engineer of the U.S. Army Environmental Hygiene Agency, Army Chemical Center, Maryland.

"I have been following with intense interest the articles in recent issues of CIVIL ENGINEERING concerning the future of civil engineering and the various suggestions for improving our profession, notably through increased research efforts and reevaluation of the civil engineering curricula. Being favorably impressed by the curriculum changes proposed at M.I.T. and having read the discussions on this subject in The Younger Viewpoint column of the January issue of our magazine, I was stimulated to further thought. Consequently I set down the following comments on what I consider to be the situation confronting the civil engineering profession today and why I feel the proposed curriculum changes are a step in the right direction, towards strengthening our profession for the future."

ALONZO WILLIAM LAWRENCE, A.M. ASCE
2d Lieutenant, MSC

Lieutenant Lawrence's commentary follows.

Need for socio-technical planning

"Our rapidly expanding population and the attendant problems and complexities of an industrial society have created severe stresses in our physical environment, the realm of the civil engineer. These stresses include the decay of our cities and accompanying urban sprawl, mass transportation teetering on the edge of extinction, and gross pollution of our air and water resources. Evidence is fast accumulating that these problems cannot be solved by a purely technical approach since the attitudes and emotions of the general public and the individual citizen are involved. There is an urgent need for socio-technical planning and coordination with public and political groups to insure that engineering projects will serve the purposes for which they are designed and not be merely monuments to the engineer. Who would be better qualified to undertake this socio-technical planning than the civil engineer educated to appreciate all the factors affecting the design and utilization of his civil engineering projects?"

The civil engineer as an environmental administrator

"In contrast to this need, however, we have seen our profession develop from the era of the traditional civil engineer, who undertook any and all engineering projects, to the present era of highly developed specialization within the profession. This specialization has become intensified in recent years in response to the growing complexity of our undertakings and a multitude of technological innovations. Hence there has been little time for the development of an accompanying philosophy to apply the specialities of civil engineering in an integrated approach to the problems of the physical environment.

Thus I welcome the recent trends in thinking of some civil engineering educators who wish to broaden the base of civil engineering education to include the social sciences and systems analysis in an attempt to correct the existing paradox. I view these changes in curricula as an attempt to develop the civil engineer as an environmental administrator, who will function as a coordinator and liaison between the public and the engineering specialists who effect environmental control. Undoubtedly many of the graduates of a broader based civil engineering curriculum would desire specialization in the form of further academic training. However, the socio-technical base established by their undergraduate training would give them a much broader conceptual basis from which to plan the programs of their specialty."

Dynamic challenge for survival

"Finally, the future of a profession is determined by its ability to attract young people into its ranks, and admittedly civil engineering has been experiencing some difficulty in this regard. It is my feeling that this situation is, in large measure, caused by the lack of a clearly defined philosophy to attract the interest and inspire the imagination of the potential engineer. The post-Sputnik era has romanticized space research and rocketry and has created a definite challenge to the younger generation considering a scientific future. In order to survive, civil engineering must offer a comparable challenge. What more worthy or dynamic challenge could we present than that of 'the combined socio-technical planning and management of man's physical environment,' which the new educational proposals suggest?"

* * * *

Qualifications and rewards in sales engineering

The May column of The Younger Viewpoint posed the question: "Is sales engineering a rewarding field for the young engineer?" The following answer was received from someone who should know—the vice president and chief engineer of a company in the sales field, Choctaw, Inc.

"In answer, I can definitely state that sales engineering is a very rewarding field for the young engineer.

"Sales experience in itself is not necessarily required, providing the young engineer has the natural characteristics for selling. He should have a good personality, pleasing appearance, have initiative, like people, be aggressive and not afraid of hard work, be able to speak and impress people with his sincerity. Any young engineer with a reasonable amount of these characteristics in his make-up, who has a good engineering background and knows his product can become a successful sales engineer. The real reward comes in engineering promotion, and then in being either responsible for getting the order yourself or having the contract awarded to the firm you represent.

"Sales engineering provides the opportunity for meeting a lot of people and making a lot of friends. A young engineer must be honest with himself. If he is not willing to work hard and is easily discouraged, he had better not start, but if he has what it takes, the rewards will justify the effort."

E. F. BESPALOW, F. ASCE
Memphis, Tenn.

HERE'S HOW TO QUENCH THE THIRST OF A MODERN 22 STORY GIANT

Downstairs, upstairs and all around the house Peerless Pumps move up to 15,000 gallons of water every minute for the 55 Public Square Building in Cleveland.

Engineering a modern building for maximum human efficiency calls for water, plenty of water. Water for the air conditioning system, water for sanitation and human consumption. Water for a hundred and one other needs that a huge building like the 55 Public Square structure in Cleveland demands on a round the clock basis.

In the 55 Public Square building the assignment of handling this water has been given over entirely to Peerless pumps. Good reasons, too. First, in the Peerless line the contractor found a complete selection of models to handle his every requirement. During initial startup, when minor adjustments were required, Peerless field representatives were on hand immediately to handle the service requirements. Since that time, the Peerless pumps have operated on a continuous basis with no downtime, moving water all through the building with maximum performance.

Investigate the Peerless lineup of quality pumps for your next building. Large or small, you'll find that Peerless quality and service are unmatched. Write us today for our catalog and the name of your nearest Peerless representative.

Upper left: These Type A pumps are handling condenser water with a 130′ head.

Upper right: Peerless Type DL pumps circulate ethylene glycol to melt snow on walks surrounding the building.

Lower left: Type TU booster pumps handle house water with a 300′ head.

Lower middle: These vertical Hydro-Line® models are handling hot condensate.

Lower right: This series of Type A pumps are in chill water service.

Putting Ideas to Work

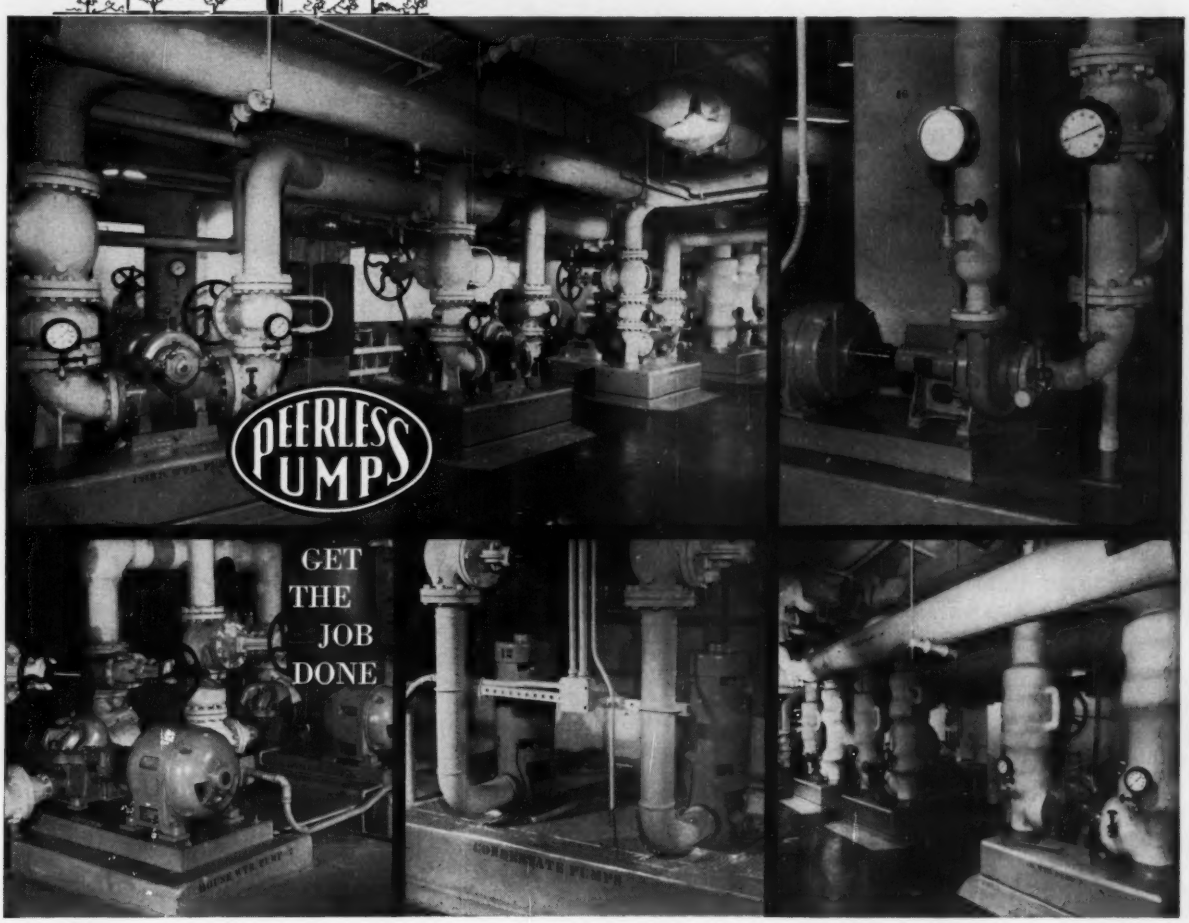
PEERLESS PUMP

HYDRODYNAMICS DIVISION

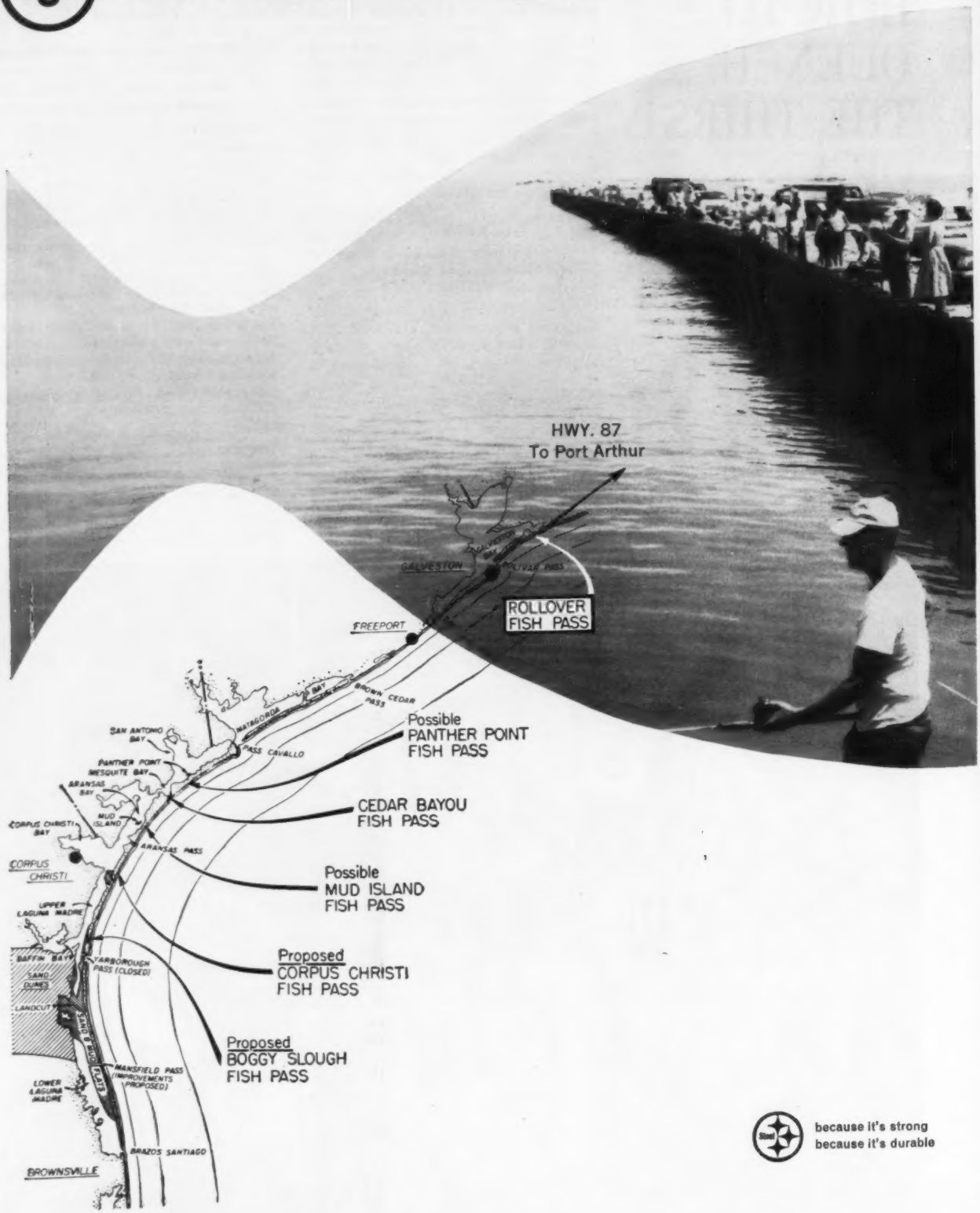
Plants: Los Angeles 31 California, and Indianapolis 8, Indiana.

Offices: New York; Detroit; Chicago; Cleveland; Indianapolis; St. Louis; San Francisco; Atlanta; Plainview; Lubbock; Phoenix; Albuquerque; Los Angeles; Fresno.

Distributors in principal cities. Consult your telephone directory.



USS Steel Sheet Piling cuts off erosion



because it's strong
because it's durable

at Rollover Fish Pass

● Rollover Fish Pass is a narrow, man-made channel that runs through a barrier island off the coast at Galveston, Texas. It was dug several years ago by the Texas Game and Fish Commission to connect the Eastern Arm of Galveston Bay with the Gulf of Mexico as part of a long-range program to improve commercial and sport fishing in the bays of the Texas Coast. Artificial waterways like Rollover improve the salinity balance of the bays and open new spawning grounds. ● At first, Rollover Pass caused trouble. Powerful tidal currents eroded the sides and widened the channel causing damage to adjacent property and endangering bridges on State Highway 87. Remedial action taken consisted of driving steel sheet piling along the sides of the Pass to stop erosion. Two steel sheet pile sills were also driven across the pass to keep the channel from scouring. Over 1500 tons of USS steel sheet piling were used for the job. ● Joe Marks, Chief Engineer for the Texas Game and Fish Commission, said, "United States Steel sheet piling was selected because of its strength and economy. I fully expect this steel sheet piling to have a long and useful life." ● Today, Rollover Fish Pass is one of the most popular fishing spots in the area. As many as 5000 people have fished here in one day. And the Pass has attracted new businesses, too—restaurants and motels have sprung up nearby. Mr. Marks said, "The operation of the pass is highly successful and fishing results have been excellent." The success of Rollover Pass has prompted the Commission to move ahead on plans to excavate additional inlets through the barrier islands along the Texas Coast. ● If you need steel piling—steel sheet piling, pipe piles or H-Piles, call the nearest U. S. Steel Office, or contact United States Steel, 525 William Penn Place, Pittsburgh 30, Pennsylvania.

Fred T. Hankey, Jr. and Joe Marks of the Texas Game and Fish Commission inspect steel piling installation at Rollover Pass.

United States Steel Corporation, Pittsburgh • Columbia-Geneva Steel, San Francisco • National Tube, Pittsburgh • Tennessee Coal & Iron, Fairfield, Alabama • United States Steel Export Co.

USS TRADEMARK **United States Steel**

NOTES FROM THE LOCAL SECTIONS

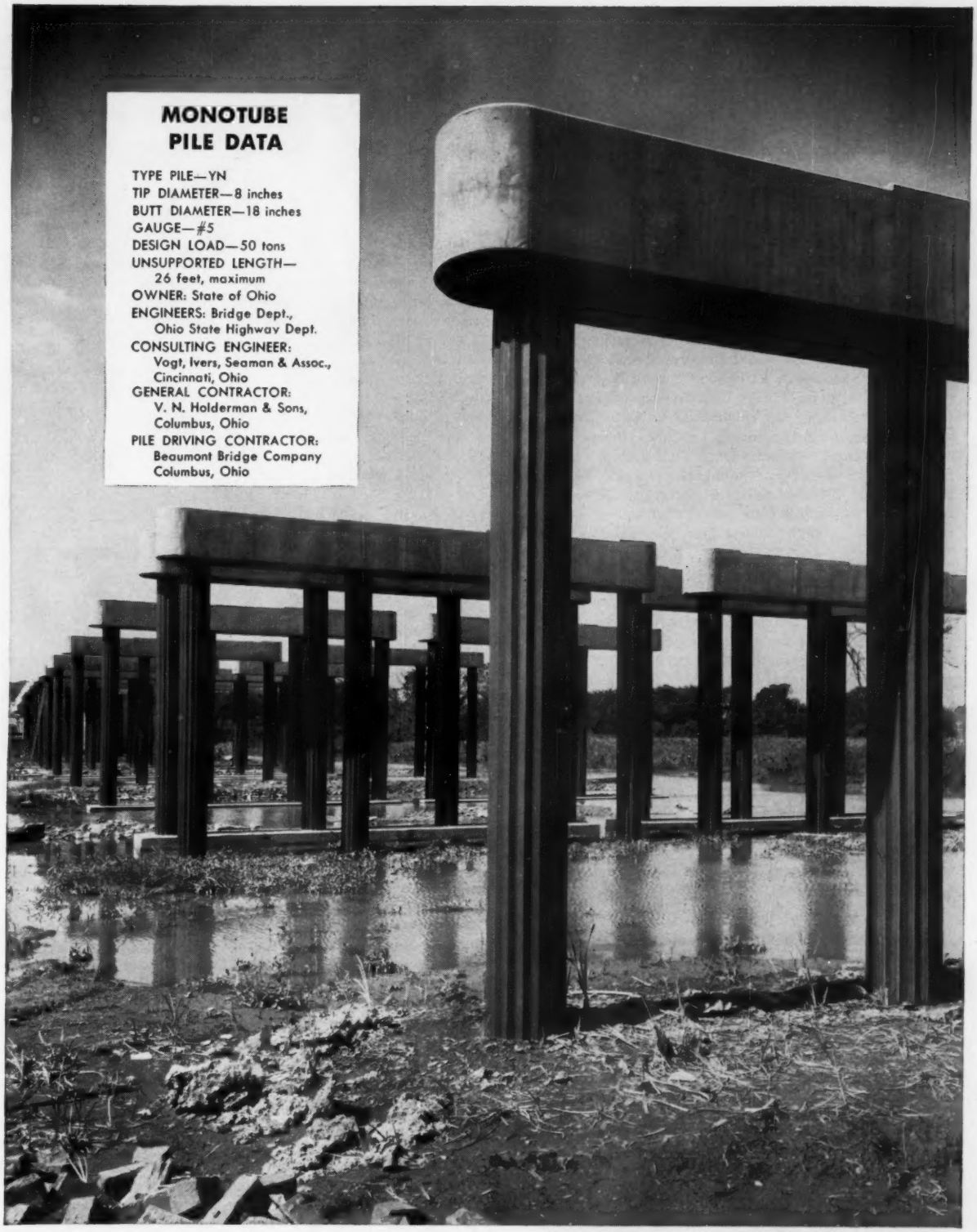
(Copy for these columns must be received by the fifth of the month preceding date of publication)

A joint meeting of the Niagara Branch of the Buffalo Section and the Buffalo Post of the Society of American Military Engineers was held on May 20 at Niagara Falls. Awards were given to the owner, designer and fabricator of the American Rapids Bridge, for receiving First Honorable Mention in Class I of the American Institute of Steel Construction's Annual Bridge Award Competition for the Most Beautiful Bridges Built during 1959. Accepting their certificates from William Bennett (second from right), regional engineer for AISE, are (in usual order) William H. Latham, representing the Power Authority of New York as resident engineer; the fabricator and erector, A. C. Bole, contracting manager with the Bethlehem Steel Company; and the designer, Emil Praeger, of Praeger and Kavanagh. The Bridge which extends from the Niagara Falls mainland to Goat Island, was the subject of an article by Mr. Praeger and his partner T. C. Kavanagh in CIVIL ENGINEERING, December 1959.

G. Brooks Earnest (left), nominee for President of ASCE and president of Fenn College, bestows the award bearing his name on two outstanding civil engineering students in the Cleveland area at a meeting of the Cleveland Section and the Fenn College and Case Institute Student Chapters. Shown (left to right) are Dr. Earnest; Ronald G. Adams, Fenn senior; and Berthold Klein, Case senior.

Bob Hall, chairman of the Vocational Guidance Committee of the Kansas City Section, presents first-place prize to James Barnett, a senior at Lincoln High School in Kansas City, Mo., for his display "Surface Tension of Water," which he exhibited in the National Science Fair competition held in Kansas City.

A total of 268 members and guests participated in the spring meeting of the Mid-South Section, recently held in Vicksburg, Miss. Of these 71 were students from the University of Arkansas, Mississippi State University and the University of Missouri. In the left-hand photo (left to right), Student Chapter members John Bunch, of Mississippi State University and David O. Scharr, of the University of Mississippi, confer with Section President W. D. Dickinson, Jr., and Vice President O. M. Carter. At the far right P. R. Payne, Jr., of Arkansas Polytechnic Institute, rounds out the group. The Vicksburg Branch was host to the meeting which consisted of technical sessions on the theme "Space-age Demands on the Engineering Sciences," tours of antebellum homes, a special luncheon for the ladies, informal buffet dinner, and a business meeting. Officers nominated for the 1962-1963 term during the business meeting are (right-hand photo, left to right), R. I. Kaufman, director; W. W. McMahon, secretary-treasurer; F. B. Campbell, vice president; O. M. Carter, president; D. M. Dougherty, director; and Professor T. W. Stallworth, director. Not shown is J. L. McKinstry, director.



VERSATILITY plus ECONOMY with Monotube piles. When soil conditions at this site in Mansfield, Ohio, prohibited conventional construction in crossing low-lying land, this adaptation of a foundation supported on Monotube steel piles proved to be an economical solution.

Tapered, fluted Monotube piles are available in lengths, diameters and gauges to meet every requirement. Write The Union Metal Manufacturing Co., Canton 5, Ohio, for complete information.

UNION METAL

Monotube Foundation Piles

BY-LINE WASHINGTON . . . . .

Major construction appropriations were moving through Congress with little real trouble as June began, though their progress was obscured by the battling over really huge programs such as the $6-odd billion housing program, added billions for space exploration activities, the $3.5 billion school-aid programs, $7 billion (eventually) for foreign aid, and the like. But appropriations for military construction (nearly $1 billion); for the Department of Health, Education and Welfare and related agencies (nearly $4.5 billion); for grants and loans for college housing ($300 million); for the so-called independent agencies—Federal Aviation Agency, Federal Power Commission, General Services Administration, etc.—(over $8.4 billion); for the National Aeronautics & Space Agency ($139 million for construction); and others seemed to be in no trouble at all.

* * *

Engineers themselves are fostering the trend toward unionism among younger men entering the profession, and they're spending too much time on protection, rather than improvement of the breed, according to two Washington experts. Dr. Leonard Ostreicher, head of the Martin Company's personnel department, told radio engineers that schools are to blame (in part) for giving students a glamorous picture which is destroyed when they start work on a drafting board; that engineers in large companies have little loyalty, are cynics, and are "standoffish"; that engineering managers don't devote enough time to human factors. And John W. Macy, Jr., chairman of the Civil Service Commission, told a Washington meeting that "the trials we face demand that the great professional organizations cast off . . . vestiges of parochialism and concentrate on improvement—rather than protection—of the breed."

* * *

A proposal for closer cooperation between engineers and federal agencies is now in the hands of executive and legislative leaders, as a counter-proposal to the establishment of any cabinet-level "Department of Science." The suggestion, authored by a special committee of the National Society of Professional Engineers, urges formation of a "National Advisory Council" for engineering and science, to promote inter-agency cooperation, and act as a liaison between engineers and scientists and the federal government. Practically all professional societies, including Engineers Joint Council, oppose formation of a federal science department.

* * *

The information that Washington's still-incomplete Dulles International Airport at Chantilly, Va., will cost as much as $90 million more than was originally estimated, has brought some sharp criticisms from Congress of the estimating methods of federal agencies: A lot of Congressmen seem convinced that the agencies' engineers habitually underestimate to get Congressional approval, then happily add on as the project proceeds. At Dulles, reasons for the added cost were listed, in order, as poor planning (by the previous Administration), bad weather, and poor supervision. The "poor planning" included no provisions for hangars at the airfield—on the original theory that airlines would provide their own. Now, the airlines have been quoted as telling the new FAA Administrator Najeeb Halaby that they won't build hangars.

The jump in Dulles airport prices wasn't the only rise that bothered Congress. It also discovered that its own new House Office Building (No. 3) will now cost at least $100 million—as compared to original estimates of $60 million or so. The enormous, monumental structure has run into all sorts of trouble including strikes, bad weather, unexpected trouble in controlling underground streams, and the like.

* * *

On housing, while Congress debated the virtues of a huge added federal program, there were signs of an upturn during April—118,700 housing units were started in that month, compared to 110,300 in March—but still well under the 125,200 started in April 1960. The housing starts, however, coupled with strong evidence of renewed industrial activity, gave solid background for construction optimists. As to private work, applications for financing proposals to the Securities and Exchange Commission during May totalled nearly $1.5 billion for new construction. Of this total, gas pipeline companies said they would spend $788.7 million during the remainder of 1961; electric utilities $620.1 million; private industrial concerns planned $76.1 million worth of work.

* * *

Aerial mapping three to four times as accurate as at present is promised by the Coast & Geodetic Survey announcement of a "breakthrough" it called "analytic aerotriangulation." In thumbnail, it is a system that mathematically controls aerial photographs more rigidly, to permit better compilation—the first time according to the Survey that a complete mathematical system with extremely high standards of accuracy has been accomplished by any mapping agency. The key is an instrument called a comparator, which measures positions on aerial photographs to the nearest 1/25,000 of an inch, transmits its readings to an electronic read-out instrument for recording on a tape. The tape is then converted to punch cards, from which computers take over to establish correct positions and elevations. A recent test (on an area in Virginia) showed errors of less than 3 ft, in photos taken at an altitude of 20,000 ft.

* * *

Can a civil engineer advertise himself as practicing architecture, if the state licensing laws permit him to "do such architectural work as is incidental to his engineering work"? Melvin W. Beck, a licensed professional of Waterville, Me., wants the U. S. Supreme Court to decide that point, after being convicted of violation of state licensing laws in two lower courts, for displaying a sign calling himself "engineer and architect". The lower courts said the intention of the state legislature was obviously to permit only necessary architectural work (or engineering work for architects) incidental to the practice of their profession.

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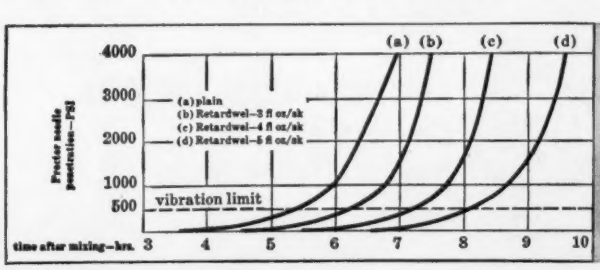


This mark tells you a product is made of modern, dependable Steel.

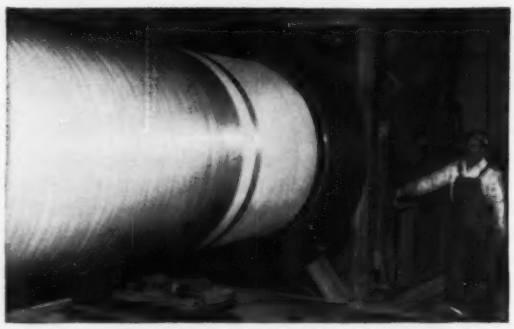
Prestressing with USS American High Tensile Grade Wire adds strength and durability to 11,000 ft. of 36″ concrete pressure pipe installed along Cincinnati main artery

Cincinnati's Montgomery Road is one of the busiest streets in town. It feeds main line traffic into Cincinnati from the Northeast. Recently the city faced the problem of extending a 36″ water line 11,000 ft. down Montgomery Road. The job had to be done fast. The road had to be kept open. The answer was Concrete Pressure Pipe prestressed with USS AMERICAN Bright-Drawn High Tensile Grade Wire. A special steel-and-rubber joint which is made quickly and easily sealed adjacent ends of the pipe.

According to contractor A. F. Jelen & Son Company, Cincinnati, the special joint allowed them to lay the pipe without a hitch, and the job was finished right on schedule. Furthermore, the joint remains bottle-tight under the heaviest traffic loads.

The prestressed steel-and-concrete pressure pipe for the Cincinnati job was manufactured by Price Brothers Company, Dayton, Ohio. It's made by forming a steel plate into a cylinder. The seam is welded and the pipe undergoes a high-pressure hydrostatic test to make certain the weld is tight. The inside of the cylinder is then covered with a layer of centrifugally cast concrete and the cylinder, with its concrete core, is wrapped with a helix of USS AMERICAN Bright-Drawn High Tensile Grade Wire made to ASTM specification A-227. After wrapping, the entire pipe is covered with mortar to protect the wire from corrosion. Tension in the wire places the concrete and steel cylindrical shell in compression. In service, the internal pressure caused by the liquid acts to overcome this pressure. Thousands of miles of this and other types of prestressed concrete pipe have been installed across the country.

USS American Steel and Wire Division pioneered the making of high tensile strength steels for prestressed concrete construction. And we are constantly working with manufacturers to make sure they get the wire they need to keep the quality of their product high. Get the complete story in our free 56-page brochure: *USS American Wire and Strand for Prestressed Concrete.* Write today: American Steel and Wire, 614 Superior Ave., N.W., Cleveland 13, Ohio. USS and American are registered trademarks



Steel cylinder, with concrete core, wrapped with USS AMERICAN High Strength Wire. Wire is then covered with mortar coating.

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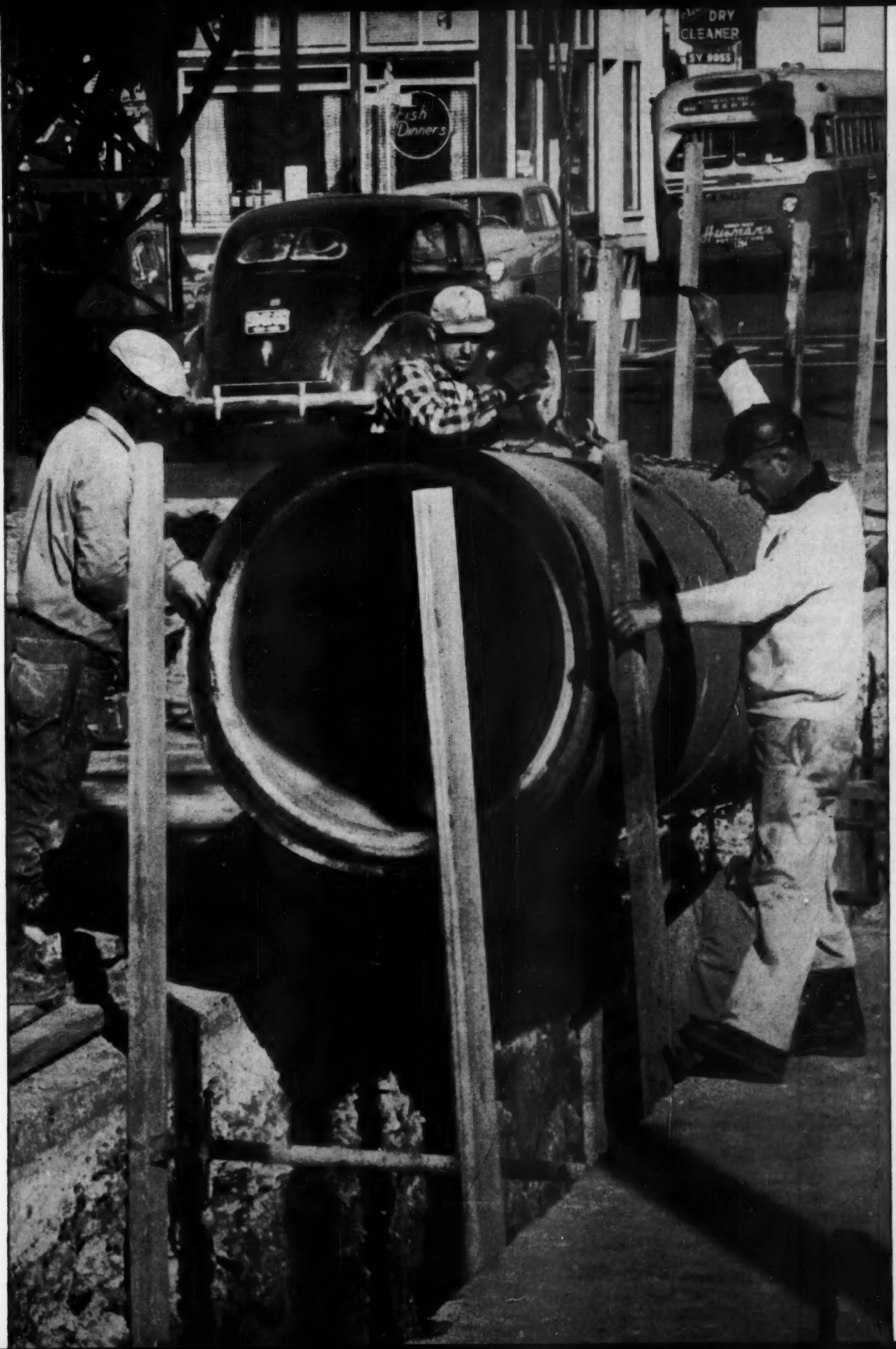
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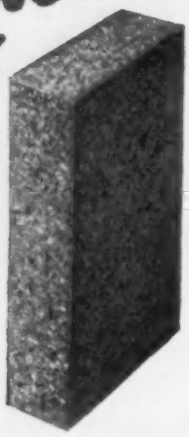

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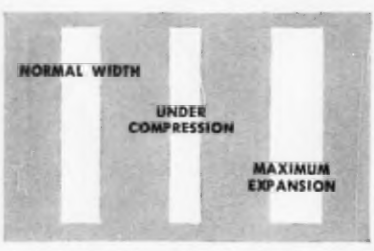

The above illustration shows how this material can expand to as much as 50% of its original thickness.

Write today for your copy of the Servicised Catalog. It contains complete information on SELF-EXPANDING CORK as well as many other types of premolded joint fillers.

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New in education

New engineering division at Case .....

The creation of a new Engineering Division at the *Case Institute of Technology* was announced by Dr. T. Keith Glennan, president, on the 80th anniversary of the opening of the first classes at Case. According to Dr. Glennan, "The engineer of tomorrow faces enlarged responsibility. He will be concerned with larger and more complicated problems . . . Thus, highly specialized training with a four-year college course is neither desirable nor possible." The new division will encompass the present departments of civil, electrical, mechanical engineering, and chemical engineering. Dr. Ray E. Bolz, at present head of the department of mechanical engineering, will head the Engineering Division, and Dr. Harry R. Nara, M. ASCE, head of the present civil engineering department, will be associate head.

Grants for research .....

A recent grant of $4,350,000 made by the Ford Foundation to *Cornell University* to further strengthen graduate study and research in the College of Engineering will be used toward the endowment of eleven professorships. The grant will cover a period of ten to fifteen years, while extra funds will be sought by the university on a matching basis from its alumni and other friends. Provision will also be made for substantial graduate fellowships and loan assistance and additional facilities for study and research.

A major research project, the largest of its kind yet undertaken in the field of air pollution, is now underway as a joint endeavor of the Los Angeles County Air Pollution Control District and the *University of Southern California*. S. Smith Griswold, director of the Los Angeles County group, will direct the establishment of four stations on sites located at varying distances from the heavily traveled throughways at which pollutants will be monitored and laboratory animals studied under precisely the same exhaust contaminated air which people breathe.

More bridge per dollar is the goal of a research project sponsored by the Ohio Department of Highways and the U.S. Bureau of Public Roads at *Ohio State University's Engineering Experiment Station*. A method of reducing the cost of highway bridges by eliminating excess safety factor—through reliable design—is included in the first annual report of a two-year, $60,000 study of skewed slab bridges. Although skewed slab bridges are frequently used, load-carrying capacity of the diamond-shaped floor sections (slabs) have never been accurately determined. The result has been that skew bridges have been built stronger than necessary with a proportionate increase in cost. The report contains data gained from a model bridge built to check the original mathematical theory at the Engineering Experiment Station.

New fall courses .....

Graduate studies in highway engineering leading to a Master of Civil Engineering is being offered by the *Catholic University of America* in Washington, D.C., beginning October 1. Qualified students may take individual courses to improve their knowledge of highway planning and design without necessarily pursuing a full master's-degree program. As an added convenience courses will be conducted in the early evening for persons employed locally who wish to continue their studies on a part-time basis. Prospective students should apply by mail to the Head of the Department of Civil Engineering before the registration period, September 27-30.

Next fall the civil engineering department of the *University of North Dakota* will offer a course in construction methods for undergraduate students. Professor Robert C. Sheldon, F. ASCE, of the University's Civil Engineering Department is writing a textbook preparatory to teaching the course. Instead of adopting the usual approach of talking about construction by types, he will break the construction process down into its six fundamental operations: breaking loose, lifting, transporting, separating and mixing, placing and fastening. Also included in the course will be a discussion of the engineer's place in the construction firm.

Fellowship in soil mechanics .....

A $3,000 fellowship for a top graduate student specializing in soil mechanics has been granted to *Northwestern University* by Soil Testing Services, Inc., of Chicago. The consulting firm feels that consulting engineers and other business organizations have an obligation to support higher education.

Nuclear energy .....

The American Society for Engineering Education and the Atomic Energy Commission, as they have every summer since 1956, are jointly sponsoring a Summer Institute Program on Nuclear Energy. The program which includes two Basic Summer Institutes, two eight-week Advanced Institutes, and three four-week Advanced Institutes, will be held at six different universities. The purpose of the Basic Institute is to give engineering college and technical institute teachers, needing background in nuclear energy, a concept of the nature of reactor problems. The Advanced Institutes are designed to provide teaching personnel with an understanding in nuclear engineering, sufficient to formulate teaching and academic research programs in the particular area of the institute attended. This year 132 applicants have been accepted.

From Cows to Cars in Boston Common

Owner: Massachusetts Parking Authority; George Lewis Brody, Chairman
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Pumping Contractor: American Dewatering Corporation, Rockaway, N. J.

Boston Common is historic ground. Massachusetts was but a colony when this land was set aside in 1634 for a "trayning field" and the "feeding of cattell". For many years both Colonial troops and cows were customary sights on the Common.

During the Revolution the Common became a rallying point for patriots, and it has continued to be a meeting spot for free men and a center for free speech. Many great celebrations have been held here. Folks long forgotten, and folks long to be remembered, alike have made use of the Common.

Now the Common is entering a new era of use. Upon its site the city is building an underground garage which will provide parking space for thousands of the cars that enter Boston daily. To enable work to be done efficiently and "in the dry", Moretrench wellpoints keep 31 feet of water under constant control.

The Common's surface has been removed only temporarily, and when the garage is roofed over, trees, shrubs and turf will be restored to their original places. The Common will continue to have its familiar and historic look. It will only have deepened in its use to people.

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News Briefs . . .

Better Water Use Urged at AWWA Conference

There is no shortage of water in the United States—merely a shortage of facilities for its transmission, its treatment, and its storage. So went the message delivered to some 3500 engineers, water utility managers, and others interested in public water supply as they attended the recent 81st annual conference of the American Water Works Association. Meeting from June 4 to 9 in Detroit's new $45 million Cobo Hall and Convention Arena, the group heard Senator Robert S. Kerr, chairman of the Senate Select Committee on National Water Resources, call for broad comprehensive planning for water development.

Senator Kerr also said that conservative estimates place the 1980 demands at twice the current daily rate of 300 billion gallons, and that by the year 2000 it is expected that this demand will be tripled. In order to meet future needs in such a way as not to inhibit national or regional economic growth, the Senator said his committee recommends that five categories of effort be intensified. These are: (1) regulation of stream flow through construction of surface-water reservoirs and through better watershed management; (2) more adequate pollution abatement; (3) better use of underground storage areas; (4) increased efficiency of water use; and (5) greater support for research programs looking into means of increasing water availability and yield.

Water utility adequacy

A capacity audience heard eight experts discuss adequacy in water utility operations. James W. MacLaren, consulting engineer of Toronto, told the group that in recent years over 1,000 water utilities in the United States and Canada had to restrict the supply and distribution of water owing to extensive urban growth and a lack of advance planning. He urged the group to utilize existing land-use plans and studies in evaluating and forecasting residential, commercial, and industrial developments. Current planning, he said, should be carried on in the light of long-range goals. Furthermore, whatever long-range scheme is adopted, it should be so flexible that any normal change in community development plans will not destroy its usefulness.

In discussing adequacy in water-utility operations from a managerial standpoint, Jack A. McCullough, superintendent of the Colorado Springs Water Division, attacked the inadequate salary scale for water works personnel. Of the registered professional engineers in the water industry, 72 percent receive less than $9,000 per year, whereas the median salary for all registered engineers is $10,000. Mr. McCullough's paper stimulated considerable discussion from the floor. Many felt that for an adequate salary scale, numerous operators and others in the field would have to raise their individual level of proficiency, possibly through increased education.

Correspondence course

Almost in direct reply to this, John H. Murdoch, consulting engineer of Wynnewood, Pa., stressed the need of an educational program with enough challenges and coverage to raise the status of water-utility managers to an adequate level. He went on to say that a nationally known correspondence school is willing to develop and administer a course with whatever content the association wished. Textbooks prepared in consultation with the AWWA would include subjects such as accounting, finance, organization, motivation, report writing, English, mathematics, chemistry, hydraulics, and water utility planning. Aimed at education for leadership in a business organization devoted to community service, the correspondence course would offer opportunities to those with limited means and to those who cannot leave their work for short courses.

W. L. Patterson, consulting engineer with Black and Veatch, Kansas City, Mo., called for a demand rate for water service. This, he defined, as a two-part rate in which charges to the individual customers are based on both the quantity of water used and the measured demand placed on the system. Properly designed demand rates can provide a far more equitable means of assessing charges to individual customers than the block-type rates which depend only on quantity.

Reuse of water was a theme that appeared throughout the five-day meeting. From the arid Southwest to the uncertain conditions on the moon, many speakers see water reuse as a necessity for adequate supply. Harry N. Lowe, Jr., of the U. S. Army Corps of Engineers Research and Development Laboratories at Fort Belvoir, Va., stated that research in the area of recovery and reuse of waste water, including water from human waste, is already well advanced. If necessary, he said, such systems could doubtless be made operative in a very short time for man's trip to the moon.

Over 100 manufacturers and suppliers in the water-works field presented exhibits in some 200 booths in the exhibit area. The well-attended show provided an opportunity for water works officials and consultants to inspect the latest equipment, materials and processes that are available to help them solve their various problems.

Fun night

One evening the Convention Arena, 320-ft-dia, 120-ft-high structure adjoining Cobo Hall, was transformed into a fun-packed carnival midway, much to the enjoyment of AWWA members and their wives and children. An array of rides, shows and games of skill attracted both the young and old.

On the more serious side was the presentation of awards and honors. ASCE members receiving awards were Lewis S. Finch, F. ASCE, vice president and chief engineer of the Indianapolis Water Company, who was awarded the John M. Diven Medal for his successful efforts "in launching and carrying forward the association's advancement program"; and William R. Seeger, M. ASCE, general manager and chief engineer of the Marin (Calif.) Municipal Water District, who received the Management Division Award for a superior paper.

Elected to honorary membership were ASCE Fellows Ray L. Derby, principal sanitary engineer, Los Angeles Department of Water and Power; Otto E. Eckert, general manager, Board of Water and Electric Light Commissioners, Lansing, Mich.; and Fred Merryfield, professor of sanitary engineering, Oregon State College.

John W. Cramer **William D. Hurst**

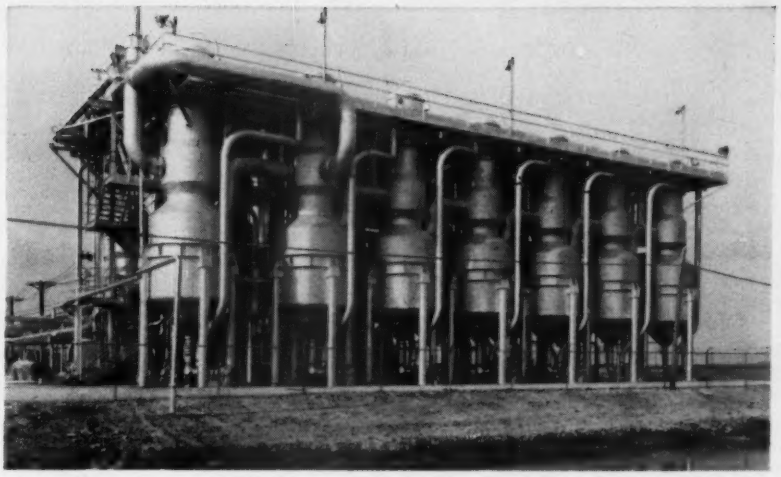
John W. Cramer, F. ASCE, consulting engineer of Lincoln, Nebr., was elected president of AWWA to succeed C. F. Wertz, F. ASCE. A Canadian, William D. Hurst, city engineer of Winnipeg, was installed as vice-president of the Association.

ICBM Missile Base in Spokane Area Completed

Work on the last of the nine Atlas intercontinental ballistic missile sites in the Spokane, Wash., area has been completed after two years of round-the-clock construction. In formal ceremonies at the Lamona site, the Army Corps of Engineers recently turned over the keys for the completed facility to the U.S. Air Force. The first of the nine Atlas sites was turned over to the Air Force late in November.

Lt. Col. Robert W. Fritz, M. ASCE, Spokane area engineer for the Seattle Engineer District, commented on the difficulties involved in meeting the exacting construction schedule. "Problems were without precedent," he said. Perhaps one of the most difficult was testing the high-pressure systems that provide the fuel, the liquid oxygen, and the helium gas used by the Atlas Missile. He said that the hundreds of instruments and miles of piping making up the propellant loading systems at the nine sites had to be subjected to pressures as high as 6,000 psi and to liquid temperatures as low as 300 deg below zero.

The project was carried out by 38 contracts, totaling more than $30,000,000. The Patti-McDonald Co., Henry George and Sons, the Blaw-Knox Co., Murphy Brothers, the White Diesel Co., and H. Halvorson, Inc., were the major contractors.



Sea Water Conversion Plant Completes Trial Run

View of new sea water conversion plant, recently completed at Freeport, Tex., shows seven of twelve large evaporators, key units in production of fresh water from the sea. Built by the Chicago Bridge and Iron Company for the Interior Department's Office of Saline Water, the facility is the government's first sea water demonstration plant. Its capacity will be 1 mgd, and the cost of operation will be less than $1.00 per thousand gallons. The plant is of the multi-stage falling film evaporator type, the first ever to employ twelve effects. In an eight-day test, completed on May 31, the plant produced 8,000,000 gal of potable water from the salty Gulf of Mexico. Though fresh water from the pioneer plant is serving Freeport and two nearby chemical plants, its importance is in providing data for future conversion programs.

Mat Puller Aids Revetment Construction

A 140-ft-wide mat puller handles a heretofore impossible job during revetment construction on the banks of the Mississippi River. The vehicle, equipped with twenty-eight 5-ft-high Terra-Tires built by the Goodyear Tire & Rubber Company, moves the huge concrete block mattress, assembled on the barge at left, to a designated spot on the lower river bank. Built in seven sections, the mat puller is the width of the mattress, which is formed by connecting concrete blocks with embedded copper-covered wire fabric. The purpose of revetment construction, a project of the U.S. Corps of Engineers at Vicksburg, Miss., is to prevent erosion of the river banks.

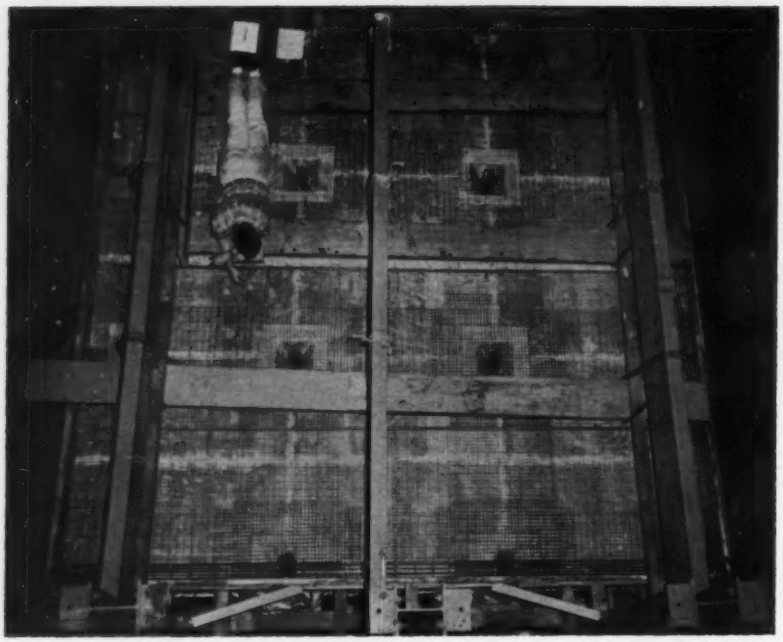
U.S. Completes Survey Of Blue Nile Basin

A four-year geodetic survey of the Blue Nile River Basin in Ethiopia has just been completed by technicians of the U.S. Coast and Geodetic Survey. The project established 365 geographic positions and 965 points of elevation above sea level, and covers more than 120,000 sq miles of rugged plateau (roughly about one-fourth of the country). It is expected that the survey will eventually pave the way for the mapping and development of the remote area by the Ethiopian Government.

The survey, the most modern of its kind yet made in Africa, completes part of a Point-Four agreement signed by the United States and Ethiopia in June 1956, calling for a program to study water resources of the Blue Nile with a view to investigating its multi-purpose development possibilities. A special service agreement between the Coast and Geodetic Survey and the International Cooperation Administration called for twelve Coast and Geodetic Survey technicians to direct the work and train Ethiopian nationals in the techniques of triangulation and leveling.

In remote areas, drill holes in rocks were used to indicate geographic positions and benchmarks, instead of the customary metal markers, which would be stolen by the natives.

For more information on this survey see article by A. R. Golzé, CIVIL ENGINEERING, Oct. 1959, p. 695.



University Tests Reinforced Concrete Flat Slabs

Construction of the fifth and final test structure of a reinforced concrete flat slab has been completed in the Talbot Laboratory at the University of Illinois. The welded-wire-fabric-reinforced slab will be studied under increasing loads and tested to failure this summer. Photo gives a top view of the structure before concrete is cast. The structure, built to one-quarter scale, represents a 60-ft square slab, consisting of nine 20-ft square panels. Student, stretched between two suspended planks, is shown checking placement of strain gauges. At his immediate right is form for one of the four interior column supports. The present test is part of a comprehensive research program into the strength of floor slabs. Sponsors are the Army Corps of Engineers; the U.S. Air Force; the General Services Administration's Public Building Service; and the Reinforced Concrete Research Council of ASCE.

UCLA Launches Study To Cut Traffic Toll

An ambitious $650,000 research program has been launched at the Los Angeles campus of the University of California to help cut this country's staggering traffic death and injury toll. The emphasis of the five-year study will be on changing, not the driver himself, but the performance of his car.

Financed by a grant from the U.S. Public Health Service, the study will be conducted by Prof. John H. Mathewson, Derwyn M. Severy and Arnold W. Siegel, of the Institute of Transportation and Traffic Engineering.

The three car-collision experts will investigate material and design changes to strengthen the car body and keep the driver from being battered inside the car during a crash. They will test their laboratory findings through actual controlled car collisions.

Six high-priority goals head the research list: (1) Cut the amount of free, unrestricted space between the driver or passenger and the sides of the car; (2) develop special safety harnesses for infants and children (conventional safety belts are of little use for children); (3) evaluate, through experimental collisions, how the basic car structure might be changed, strengthened, or made more or less rigid, to cut driver and passenger injuries; (4) test high-strength, shock-absorbing materials, such as honeycomb laminates and foam-in-place metals and plastics; (5) protect pedestrians through changes in car front end design; and (6) exchange information with other researchers in the car-collision field to get a clearer idea of what has been accomplished elsewhere.

Throughout the five-year program, the institute will publicize its findings through reports, meetings and films.

Construction Spending Rises During May

The value of new construction put in place in May came to $4.8 billion—up 11 percent from April and 3 percent above the May 1960 level—according to preliminary estimates of the Bureau of the Census of the U.S. Department of Commerce. The normal seasonal increase between April and May is 9 percent.

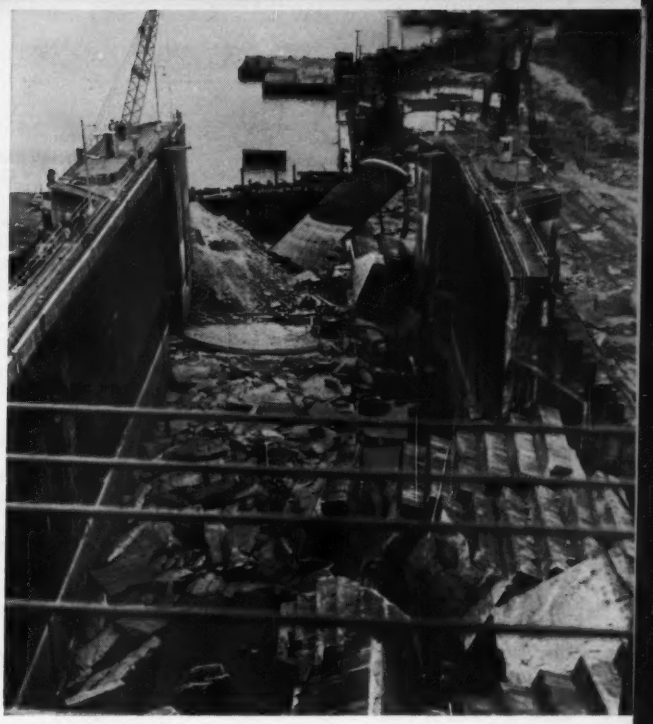
Total new private construction expenditures during the month amounted to $3.3 billion—an increase of 9 percent over April and of 1 percent above May 1960. Swelling private construction spending were outlays of $1.8 billion for residential building, an increase of 10 percent over April but a drop of 2 percent from the May 1960 level. Public construction expenditures, this May, amounted to $1.5 billion—up 18 percent from April and 7 percent from May of last year.

Cumulative spending in the first five months of 1961 also registered an increase over spending in the comparable five-month period of 1960—$20.4 billion compared with $20.1 billion.

Long Suspension Bridge to Span Tagus River

A contract for the construction of the longest suspension bridge in Europe has been signed by the United States Steel Export Company and the Portuguese Government (April issue, page 91). The two-mile structure, which will cross the Tagus River at Lisbon, will have a center suspension span of 3,318 ft—the longest in Europe and fifth longest in the world—and two side spans of 1,540 ft each. U.S. Steel Export is the prime contractor for the four-year project, which was designed by the New York firm of Steinman, Boynton, Gronquist & London and the Tudor Engineering Company, of San Francisco. The American Bridge Division of U. S. Steel will fabricate structural steel for the main bridge structure, and construction of the main piers and approach roadways will be undertaken by International Morrison-Knudsen Company and its French associates.

Rebuilding starts at Wheeler Lock



About 400 ft of the 72-ft-high landward wall of the lock at Wheeler Dam moved outward a distance up to 35 ft. Some monoliths 40 ft long then tipped back into the lock chamber. Originally the wall was in line with the guide wall seen beyond the gate.

The landward wall of the navigation lock at Wheeler Dam—just upstream from Muscle Shoals—failed almost completely on Friday, June 2. This wall, 72 ft high, is now being rebuilt on an around-the-clock, seven-day-a-week schedule to restore navigation at the earliest possible time to the 360 x 60-ft lock.

At the time of failure the downstream gates were closed, the upstream gates were open and the lock chamber was full of water. A tugboat with an eight-barge tow had just moved out of the lock upstream when the failure occurred. The tow was not damaged. At the lock two men were killed, one apparently by falling concrete, and five others were injured.

Wheeler is one of nine dams on the main stem of the Tennessee River operated by the Tennessee Valley Authority for navigation, flood control and power. It was built in 1933-1934 under a contract with the Corps of Engineers, U. S. Army—made before TVA came into existence in the spring of 1933. The vertical lift at the dam is 48 ft, and the lock is built directly into the dam.

Navigation on the Tennessee above Wheeler Dam has been halted for perhaps six months to a year. Some 50,000 cu yd of concrete must be removed and replaced. Provision has been made to immediately install transfer lines over the dam at a non-overflow section for movement of petroleum products and grain, two principal traffic commodities. However, there are very few tanker barges upstream, which creates a problem. Some dredging is being done downstream and mooring facilities are being installed to facilitate transfer. A Saturn Booster too big for highway movement will be transported by water from the Redstone Arsenal at Huntsville and hauled around Wheeler to another big barge for transport to Cape Canaveral.

Work was under way between the wall that failed and the shore to install an additional lock 600 x 110 ft, to permit movement of large tows without breaking them up. A cofferdam had been constructed around the area for the larger lock. This had been dewatered and rock excavation was under way for foundations for the lock walls. Thus, the hydrostatic head on the wall was several feet greater than that it had previously carried. It can be suspected that a surge of water from the towboat's propeller added momentarily to the head.

No statement on the failure of the structure is available from anyone connected with the project. A section of the lock wall some 400 ft long is known to have moved outward from the chamber as much as 35 ft. As will be seen from the photos, much of the wall is still standing. After sliding, some of the 40-ft-long monoliths tipped back into the lock chamber.

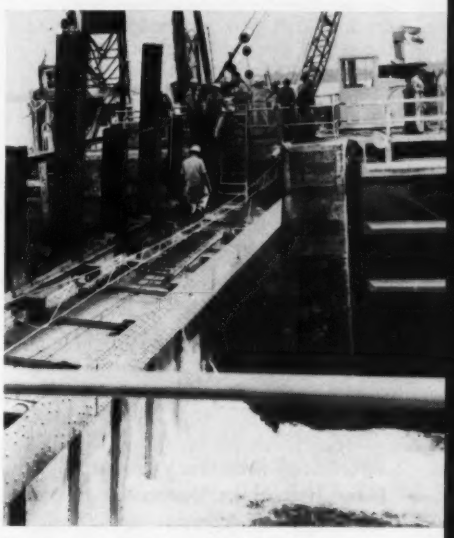
The wall section at the downstream gate moved outward. This permitted failure of the two-leaf radial gate, which depended on arch action to resist the head. One of the leaves can be seen in the photo; the other is underwater downstream.

With the wall gone, a flow estimated at 15,000 cfs went through the 60-ft-wide opening. The upstream gates could not be closed in this flow. The million-acre-ft reservoir was lowered 7 ft by withholding flow at upstream dams and discharging through Wheeler. An emergency gate beam was laid across the opening and wide-flange beams set to guide and support closure plates. The miter gate was then closed and a cellular sheet-pile cofferdam built across the downstream end of the lock. (The section of wall that included provision for an emergency gate downstream had moved out of position.) The lock area was dewatered on June 15.

Information has not been released on whether the sliding occurred at the contact of the concrete with the rock or in the rock formation. The foundation material at Wheeler Dam (as described in CIVIL ENGINEERING, April 1935, vol. p. 205) ". . . is made up of a series of sedimentary beds lying nearly horizontal. They consist chiefly of cherty and siliceous rock, of a more massive type than the usual shale, alternating with layers of a very fossiliferous and almost pure limestone. In this series the shale beds are much thicker than the limestone ones, and alternate with them."

In the area where failure occurred, excavation originally was made to 5 ft outside the wall to permit construction of the second lock without disturbing the first. Thus there was no rock shoulder to resist initial movement.

An investigation is being made of factors that may have contributed to the failure. Meanwhile reconstruction is proceeding with all possible speed.



An emergency gate was placed to control the flow so that the undamaged upstream gate could be closed.

At the time of the failure, excavation was under way for a 600 x 110-ft lock alongside the original lock, and the land side of the wall had been dewatered

Institute for Rapid Transit Established

A new nationwide organization established to promote development, expansion, and modernization of rapid transit in metropolitan areas was launched in Philadelphia, on June 7, by a group of prominent transit operators and equipment manufacturers. Formed to help solve today's pressing transit problems, the Institute for Rapid Transit replaces the Transit Research Corporation, formed in the early 1930's. Headquarters of the non-profit organization will be the Merchandise Mart in Chicago. Walter J. McCarter, general manager of the Chicago Transit Authority, is president.

Specific objectives of the Institute for Rapid Transit include promoting and coordinating technological advances in rapid transit equipment and facilities; maintaining liaison with planning and other organizations; and studying rapid transit planning and coordination of rapid transit and suburban railroad planning.

Sees Steel Industry Stronger Than Ever

The steel industry has come through the recession "stronger than ever" and thus is better prepared for whatever the future may hold, according to Benjamin Fairless, F. ASCE, president of the American Iron and Steel Institute. Speaking at the Institute's 69th general meeting, held in New York City on May 25, Mr. Fairless stressed the progress being made in the industry's new program to promote the use of steel and steel products.

Mr. Fairless noted that in the past year at least 70 new products were placed on the market by steel companies, and that more than 30 new surface treatments were developed. "Some of these products," he said, "have opened up new markets for steel that never before existed, while others have preserved markets threatened by other materials, or imported steel." Among other developments, he cited a recent survey showing that the number of men engaged in product and research development has increased as much as ten-fold. There has also been an increase of over 30 percent in the use of consultant designers, stylists, and product development groups.

Technical Advisory Group Established in Detroit

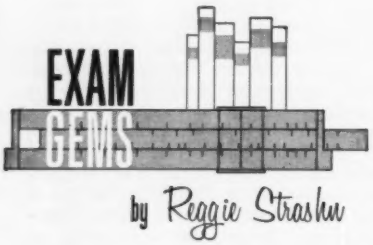
Through cooperative arrangements made by the Engineering Society of Detroit and the U. S. Department of Commerce Office of Technical Services, a scientific and engineering technical advisory group has been formed in Detroit. The purpose of the advisory group is to analyze and review from 200 to 600 Government Research Reports each month and determine their significance for Detroit industrial firms. On the basis of the reports, the technical advisory group will then suggest the kinds of local industries which could develop new processes and products.

In announcing formation of the group, Mayor Louis C. Miriani noted that the government spends $8 billion a year in research into new processes and products, the results of which are available to American industry. Since 96 percent of Detroit's industrial establishments are not large enough to maintain research staffs to analyze the large volume of technical reports, it is expected that the new service will have a beneficial effect on the economy of the city.

Army to Unify Ice and Snow Research Groups

A plan for unification of its two agencies conducting research in the field of snow, ice, and frozen ground is announced by the U. S. Corps of Engineers. The Snow, Ice and Permafrost Research Establishment at Wilmette, Ill., has been redesignated the U. S. Army Cold Regions Research and Engineering Laboratory (CRREL), and the Arctic Construction and Frost Effects Laboratory, of Waltham, Mass., has been placed under the command jurisdiction of the CRREL director, Col. W. L. Nungesser.

The plan, on paper at present, paves the way for merging the two agencies late this fall, when they will move into new headquarters being constructed for the joint group at Hanover, N. H.



The typical solution to EXAMGEM 24 presumed the situation diagrammed in Fig. 1. The spillway crest 5 ft above the invert of the canal was approached uniformly by 650 cfs on a slope of 0.0005 at a depth (computed) of 6.48 ft. The side spillway was to be long enuf to divert an excess so that the retreating 467 cfs (computed) would flow at normal depth of 5.5 ft. The varied flow in the canal diminished in harmony with the varied spill along the crest. For any point B, the spill would be

$$q = 3.34\ H^{1.47} \quad \ldots\ldots\ldots\ldots\ldots\ldots (1)$$

sec-ft per foot of crest, the canal discharge would be

$$Q = 2.078\ AR^{2/3} \quad \ldots\ldots\ldots\ldots\ldots\ldots (2)$$

where $2.078 = 1.486\ \sqrt{0.0005}/0.016$ and A and R are the area and hydraulic radius for $y = H+5$, and Q would be diminishing at the rate of q per foot.

Those who turned to calculus computed enuf of the stage-discharge relation from Eq. (2) to approximate it with a parabolic form

$$Q = 386 + 156H + 15.5\ H^2 \quad \ldots\ldots (3)$$

Then, since $dQ = q\ dL$,

$$(156 + 31\ H)\ dH = 3.34\ H^{1.47}\ dL \quad \ldots (4)$$

$$L = \int_{0.50}^{1.48} \frac{1.56 + 31H}{3.34\ H^{1.47}}\ dH =$$

$$64.5 \text{ ft.} \quad \ldots\ldots\ldots\ldots (5)$$

Another, who had thrown his calculus book away when the boss bought an IBM, reached about the same conclusion with the iteration of Table 1. It needs no explanation, since Q is derived from Eq. (2), q from Eq. (1), and $\Delta L = \Delta Q/q$. But note the tactical advantage of equal increments of depth, from which increments of length are computed directly. Others who chose equal increments of length had to compute depth by cut and try. Note also that q is computed from the mean H instead of averaging the end values. And finally note the precision with only 5 segments; those who used 10 gained little precision with twice as much work.

Table 1. Computation by Iteration

D	Q	ΔQ	H	q	ΔL
5.5	467				
		35	0.6	1.58	22.2
5.7	502				
		36	0.8	2.40	15.0
5.9	538				
		38	1.0	3.34	11.4
6.1	576				
		39	1.2	4.37	9.0
6.3	615				
		35	1.39	5.42	6.5
6.48	650				
					64.1

Ironically, and as an anticlimax, the answers are all wrong. The specific energy of approach is 6.88 and of retreat 5.84 ft; what happens to the difference of 1.04 ft? The problem was cited as an EXAMGEM in spite of its call for model analysis because solutions based on the incorrect diagnosis gave an excellent example of iteration by increments of depth instead of length.

The example is complete, but if the problem were left without a correct solution, letters of protest would reach the Editor. Space does not permit it in this installment, so the problem, to be solved with due regard for conservation of energy, will be reassigned as EXAMGEM 25. Since the pro rata time for an exam-room solution was less than an hour, the analysis cannot be "complete and exact," but reasonably approximate. Anyone who has watched gutter flow rushing blithely past curb inlets should know what is meant.

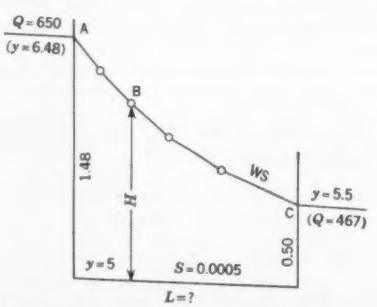


Fig. 1. Typical but incorrect diagnosis.

New Publications

Concrete design . . . . Problems of shearing strength in concrete slabs and footings are considered in a recent publication of the Portland Cement Association, identified as Bulletin D47. The work reported was carried out by Norwegian Engineer Johannes Moe during a period as visiting staff member of the Association's Structural Development Section. The problems—also under study by a joint committee of ASCE and the American Concrete Institute—are of utmost importance to efforts to improve structural concrete design methods. Inquiries should be addressed to the PCA Research and Development Laboratories, 5420 Old Orchard Road, Skokie, Ill.

Asphalt . . . . Publication of Volume 29 (1960) of the Proceedings of the Association of Asphalt Paving Technologists is announced. The reference includes papers on drying and heating of aggregates, quality mix control, effects of fillers, wire reinforcement, composition and properties of asphalt, testing methods, epoxy resins and other additives, and laboratory-simulated traffic testing. Volume 29, priced at $6.50, may be obtained from the Association of Asphalt Paving Technologists, Box 619, Ann Arbor, Mich.

Water quality . . . . Availability of the Proceedings of the recent Conference on Physiological Aspects of Water Quality is announced by the Department of Health, Education and Welfare. The 244-page volume focuses attention on the subjects of water quality, minerals and trace elements. The effects of insecticides, pesticides, and other organic substances are also reviewed. Copies are available from the Chief, Research and Training Grants Branch, Division of Water Supply and Pollution Control, Public Health Service, Washington 25, D.C.

Research, Corps of Engineers . . . . To facilitate ordering publications of the Waterways Experiment Station, the U.S. Corps of Engineers has released a List of Publications currently for sale, together with prices and other pertinent data. The listing may be obtained from the Waterways Experiment Station, Vicksburg, Miss.

Photogrammetry . . . . In "Analytical Photogrammetry," Prof. Robert D. Turpin, of the University of Texas, aims to provide persons employing photogrammetric methods with a concise discussion of the underlying mathematics needed. His presentation—issued as a Circular No. 27 of the university's Bureau of Engineering Research—should serve to explain and analyze some common approaches to solving measurement interpretation problems. Inquiries about Circular 27 should be sent to the Bureau of Engineering Research, Box 7977, Austin 12, Tex.

Professional manpower and education, China . . . . A report on Communist China, released by the National Science Foundation, sees that country's scientific effort geared to meet immediate technological demands, its education undergoing rapid change and expansion, and its development as a major industrial power handicapped by its population problem. "Professional Manpower and Education in Communist China"—by Leo A. Orleans, senior research analyst, Library of Congress—is an assessment of often confusing and contradictory data reported by Communist and other sources. Copies may be obtained from the U.S. Government Printing Office, Washington 25, D.C., at $2.00 each.

Traffic at shopping centers..... Field studies of traffic at regional shopping centers comprise a new publication of the Yale University Bureau of Highway Traffic. The study—entitled "Traffic Characteristics at Regional Shopping Centers"—is primarily concerned with fluctuations in traffic volume and parking situations at specific centers. Single copies may be obtained, without charge, from the Bureau of Highway Traffic, 311 Strathcona Hall, New Haven, Conn.

Materials testing.... Issuance of a 62-page listing of ASTM publications is announced by the American Society for Testing Materials. The listing describes more than 300 publications of all types—forty of them new and not previously listed. The listing is free, upon application to the American Society for Testing Materials, 1916 Race Street, Philadelphia 3, Pa.

Water resources . . . . The first complete report on the water resources of the Houston-Gulf Coast area has been prepared by the Houston engineering firm of Lockwood, Andrews & Newnam, Inc., who were commissioned by the Texas National Bank of Houston. The authoritative survey bears out the belief that the region has adequate supplies of low-cost water to serve the needs of new industry permanently. It includes detailed data on ground and surface water supplies, potential supply, and projected demand through the year 2000. Requests for the survey should be typed on company letterhead and addressed to the Business Development Department, Texas National Bank, Box 2559, Houston 1, Tex.

Water and sewerage systems . . . . Availability of the Proceedings of the 23rd Annual Short Course for Superintendents and Operators of Water and Sewerage Systems is announced by the Engineering Experiment Station of Louisiana State University. The reference, identified as Bulletin No. 65, may be obtained from the Engineering Experiment Station, Louisiana State University, Baton Rouge 3, La. It is $2.50.

Snow and ice research.... An annotated bibliography of research literature on snow, ice, and permafrost, prepared by the Library of Congress for the Corps of Engineers, is now available to science and industry through the Office of Technical Services, Business and Defense Services Administration, Washington 25, D.C. The 215-page volume—the fourteenth is a continuing series of specialized bibliographies in the field—is identified as PB 171 190. It is $3.00.

Photo of stressing end of a single tee to be used in large parking garage with spans of 63' and spaced 28' apart.

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Houston's parking problem will be reduced by the Allright, Inc. parking garage* (250 car capacity and 3000 sq. ft. of retail space). Using poured-in-place, pan type construction; joists are 18½" deep, maximum spans of 50'6", maximum bay width 43'6". Slabs covering the roof and retail areas are post-tensioned to render them waterproof.

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Other parking garages using Prescon System: Dalton, Dallas; 1st Nat'l Motor Bank, Longview, Texas; Major Oil Company, downtown, Houston; Beverly Hills, (Calif.); Am. Nat'l Bank, Denver; Bd. of Trade, Kansas City; Hollywood Legion Bowling, (Calif.); Remington-Rand and Baldwin Chevrolet, Los Angeles.

*Consulting Engineers: Mullen and Powell, Dallas
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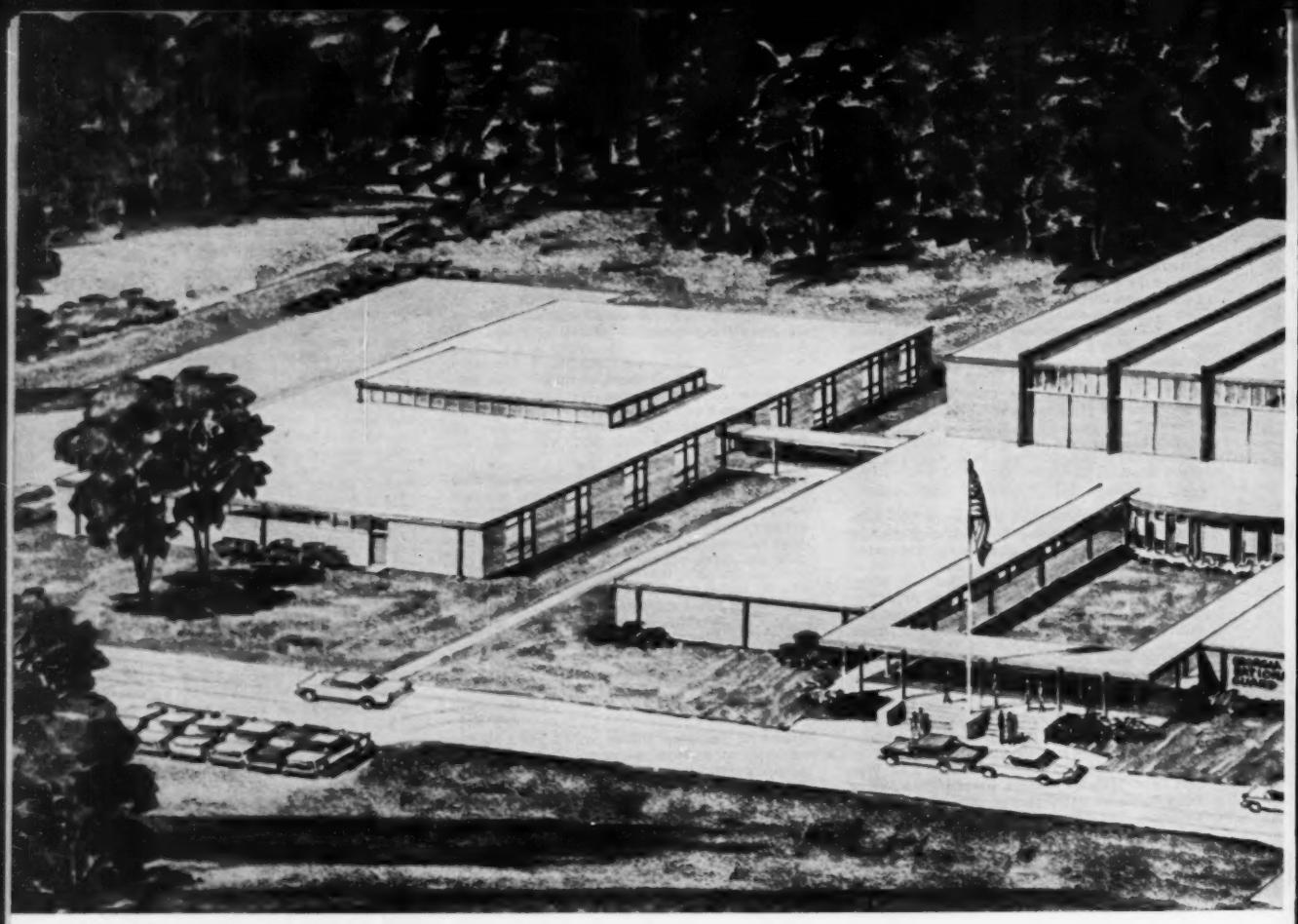


Plastic design of Georgia armory cuts weight of steel frame 15 per cent

Rigid-frame bents spanning 120 feet set new U.S. record for longest plastic-designed clear span

The Georgia National Guard Armory in Savannah, scheduled for completion late this summer, includes three steel-framed buildings linked by covered walkways. The central structure contains two headquarters and administration wings, and a column-free drill hall which will seat 5,000 when used as a sports arena. The two flanking buildings are each large enough to hold four company-size units.

Frames are outside of buildings

Seven 120-ft-long, rigid-frame bents, 20 feet center-to-center, span the drill hall. Clear height is 30 feet. Each of the 15-ton bents was fabricated from 33 WF 152 lb sections, giving a depth-span ratio of 1:44. Eight-inch purlins are framed into the bottom of the wide-flange sections, to expose the major portion of the frame outside the building.

The architects also derived an aesthetic as well as a functional use of the steel frame in the flanking buildings by exposing the columns. These support 12-inch channels which act as a fascia, and 12-inch light beams which frame the roof.

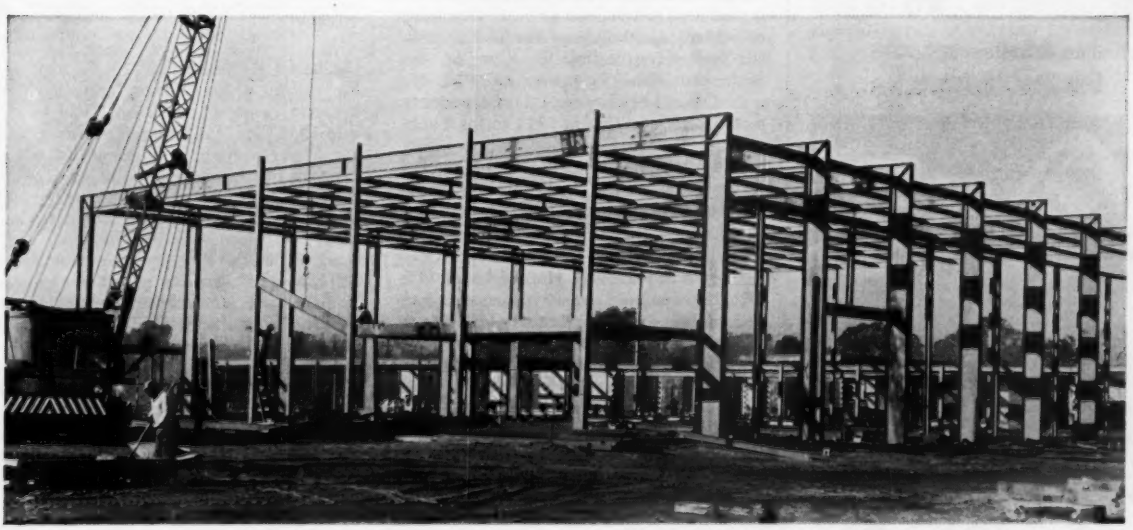
15 per cent savings in steel

By using plastic design, the architects were able to reduce by 15 per cent the amount of structural steel needed to frame the buildings, as compared with the requirements necessary under the elastic method.

Steel design by the plastic method is a new development in design technique, and generally results in a more efficient structure with less steel required to achieve the same strength. It also saves on the cost of engineering, since it demands less engineering time on the part of the designers.

If you would like a copy of a 10-page AISC booklet on "Supplementary Rules for Plastic Design and Fabrication and Rolled Beam Properties for Plastic Design," write to us at Bethlehem, Pa.

Steel is used extensively throughout the Georgia National Guard Armory, not only as a structural system, but also as frames for windows, canopies, and glass curtain walls. *Architects and Engineers:* Thomas-Driscoll-Hutton. *General Contractor:* Hugh Jackson. *Steel Fabricator:* Owen Steel Company. *Steel Erector:* Steel Erectors, Inc. The major portion of the 310 tons of structural and miscellaneous steel was supplied by Bethlehem.



Light weight of plastic-designed steel frame minimized difficulties created by poor subsoil conditions and led to economies in foundation construction.

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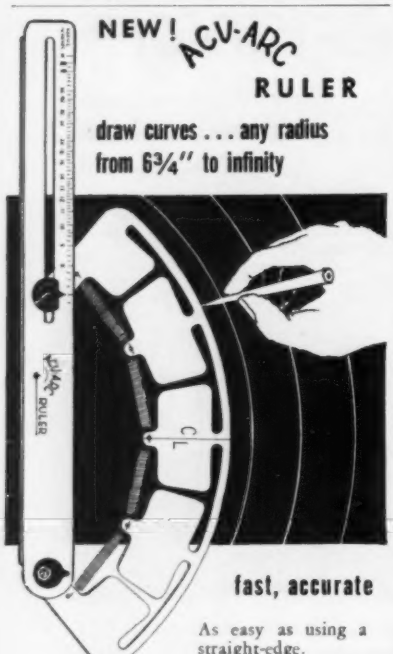

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Barstow, Calif., *Dist. inquiries invited*

DECEASED

Former Director Dean Edwards, Dies

Dean G. Edwards (M. '20; F. '59), age 78, a partner in the New York consulting and engineering firm of Edwards & Kelcey, died in Belleville, N.J., on June 5. He was chief engineer for the Borough of Manhattan in the 1930's and during World War II was chief of the Construction Branch of the War Production Board. Later, he took part in the construction of the New Jersey Turnpike, the Garden State Parkway and the Connecticut Turnpike. In addition he served as consultant to the Water Resources Board for the Susquehanna, Delaware and Hudson River Basins.

Mr. Edwards was Director of ASCE from 1943 to 1945. He had also been prominent in the Metropolitan Section.

Frederick Glaeser (M. '29; F. '59), age 73, after some 30 years as engineer, coordinating engineer and superintendent in the Construction Department of the Consolidated Edison Company of New York, in 1954 opened a consulting office in that city. Earlier he served with the Board of Water Supply of New York City in various capacities ranging from rodman to section engineer on the Kensico dam and reservoir project.

John Farenwald (M. '35; F. '59), age 73, prominent in Pennsylvania engineering circles, had retired as chief estimator of bridges and buildings in the Fabricated Steel Construction Division of the Bethlehem Steel Company in 1952. He joined the Lackawanna Steel Company in 1913, transferring in 1914 to the Lackawanna Bridge Company, which subsequently became a subsidiary of Lackawanna Steel. A few years later he began his career with Bethlehem when it absorbed both firms.

Frederick Ruthrauff Hoover (A.M. '15; M. '59), age 84, twenty years ago had become head of the Kansas City Bridge Company, after an earlier affiliation with the Pioneer Construction Company. At the time of his death, Mr. Hoover was chairman of the board of the Kansas City company.

Henry L. Jacques (M. '22; F. '59), age 79, retired from the Los Angeles Water and Power Department in 1946 after a distinguished career as engineer in charge of such major construction projects as the eleven-mile Mono Craters Tunnel and the Bouquet Canyon Reservoir. Captain Jacques was commissioned in the U.S. 27th Engineers during World War I.

Roger Thomas James (M. 39; F. '59), aged 74, until his retirement last year had been asistant city engineer of Charlotte, N.C., for 32 years. Previously he was an assistant engineer with the Southern Railway, with the North Carolina State Highway Commision, and a consulting engneer in Charlotte.

Edmund D. Johnstone (A.M. '21; M. '59), age 76, who supervised construction of many Staten Island, N.Y., projects, including Lyons Pool in Tompkinsville, and Faber Pool in Port Richmond, was slum clearance coordinator for Skidmore, Owings & Merrill, of New York, at the time of his retirement in 1959.

Philip W. Kniskern (A.M. '19; M. '59), age 72, nationally known builder, real estate broker, and appraiser, was appointed in 1955 as a special consultant to the Urban Renewal Administration of the Housing and Home Finance Agency in Washington. A past president of the Urban Land Institute, he was one of the first to push for urban renewal projects. Beginning his career as a civil engineer, Mr. Kniskern helped build some of New York's largest skyscrapers, among them the Woolworth, Equitable Life and Municipal Buildings.

Arthur C. Lee, Jr. (A.M '.59), age 24, at the time of his death was on leave of absence for military service from Ebasco Services, Inc., where he was hydraulic engineer of the Concrete-Hydraulic Division. Following graduation from Worcester Polytechnic Institute, Mr. Lee joined Ebasco as a cadet engineer in 1957.

Chester K. Smith (M. '20; F. '59), age 76, during a long career specialized in railroad construction. From 1934 to the mid-1950's he was research engineer with the Western Association of Railway Executives in Chicago (now the Association of Western Railways), having previously served as assistant bridge engineer and bridge engineer with the Spokane, Portland & Seattle Railway Company from 1911 to 1917, and as assistant engineer and special representative to the president of the Union Pacific Railway from 1922 to 1932.

Lindsay P. Disney (A.M. '30; M. '59), age 65, assistant chief of the marine data division of the U.S. Coast and Geodetic Survey, began his career with the survey in 1916 as a mathematician. During this extended period he made many contributions in the field of tides work and prepared the first tidal current charts published by the group.

Carroll L. Mann (M. '21; F. '59), age 84, for almost half a century a member of the North Carolina State College faculty, was head of the department of civil engineering there from 1916 until his retirement in 1948. In addition to his work as teacher, Professor Mann supervised the erection of the college's famed Memorial

Tower, a 122-ft edifice built as a memorial to State College alumni killed in World War I. He was honored in 1946 when State College named its four-story civil enginering building Mann Hall.

John A. Miller, Sr. (M. '33; F. '59), age 74, well known in the construction equipment field in the United States and Canada, was chairman of the board of the Rosco Manufacturing Company, of Minneapolis, Minn. He had been with Rosco since 1953 when he joined the firm as secretary. One year later he became president; and then in 1959, board chairman.

Carter Page (M. '59), age 56, nationally known authority on water resources, had retired last November after six years as chief of the Planning Division, Civil Works, in the Office of the Chief of Army Engineers. Mr. Carter who first joined the Corps of Engineers in 1929 in connection with the Nicaragua Canal Survey Waterway, ten years later was a member of a mission of civil and military engineers sent to Central America to investigate the possibilities of a barge canal across Nicaragua. During World War II he was engaged in operations at Casablanca and Naples and in the planning and mounting of amphibious operations against Sicily, Italy and Southern France, for which he received the Army Commendation Medal with Oak Leaf Cluster, the Bronze Star, the Legion of Merit with Oak Leaf Cluster, and the French Croix de Guerre.

Grant H. Potter (M. '40; F. '59), age 61, former senior partner of Charles A. Maguire & Associates, in his capacity as head of that organization, had overall supervision of such projects as the North-South Freeway and Olneyville Expressway in Rhode Island, the East Boston Elevated Highway and on a joint venture, the Central Artery in Boston. In his specialty of hydraulics and sanitary engineering, he did extensive work on the East Providence sewerage and water supply systems and on the Boston Metropolitan District Commission's expanded sewerage, tunnel and pumping facilities.

George A. Quinlan (M. '17; F. '59), age 80, an early advocate of wider pavements, extra lanes at important intersections, standard construction specifications, superhighways, and landscaping of expressways, is also credited with being the first to use the study of traffic patterns as an aid to planning roads. He was the first superintendent of highways for Cook County, Illinois. He was later employed by the Great Lakes Dredge and Dock Company and also worked as a contracting engineer in the construction of highway bridges.

Justin Oakley Reynolds (A.M. '00; M. '59), age 90, retired ince 1940, was a former New York engineer and attorney. He held degrees in civil engineering and law from the Union College, of Schenectady, N.Y., and from New York Law School.

James H. Roach (M. "33; F. '59), age 78, from 1925 until his retirement in 1953, was chief valuation engineer with the New York Central System. His first job as draftsman and designer with the Missouri Pacific Railroad, was followed by employment with the Lake Shore and Michigan Southern Railroad, the Cleveland Short Line Railroad, and, in 1918, the New York Central.

Harrison G. Roby (M. '24; F. '59), age 78, was chief of the Hydro Power Branch in the Office of the Army Chief of Engineers, from 1944 until his retirement in 1955. Previously he had been engaged for over 30 years on power project design and construction in the mid-West. For the past three and one half years he was associated with the Tudor Engineering Company in Washington, D.C., as a consultant to the International Cooperation Administration on hydroelectric projects in the foreign aid program.

Frederick O. Runyon (M. '39; F. '59), age 86, senior partner in the Newark, N.J., engineering firm of Runyon & Carey, had been consulting engineer for public works projects throughout the state. He was a former president of the New Jersey Board of Professional Engineers and Land Surveyors, and president of the Newark District Telegraph Company for 30 years, until last March, when he became chairman of the board.

Alex Magnus Torpen (M. '26; F. '59), age 79, during a long career had responsible charge of hydroelectric construction in the United States, South America, Japan and Canada, including Holter Dam in Montana and the Pachacha Power and Lake Junins projects in Peru. Over the past 20 years, extensive interests in mining, dredging, and a platinum and gold concentrator, kept him in Colombia.

Herman Frederick Wiedeman (M '27; F. '59), age 72, as president of Wiedeman and Singleton, headed an engineering firm which over a 34-year period has helped design much of Atlanta's (Ga.) existing sewer and water system. Although his early work as an engineer was in construction of Eastern railroads, since 1923, when he and the late Micajah Thomas Singleton formed the firm of Wiedeman and Singleton, Mr. Wiedeman had specialized in water supply, sewerage and sewage treatment.

Charles Benson Wigton (A.M. '14; M. '59), age 75, since 1959 chairman of the board of the Wigton-Abbott Corporation, had earlier served as corporation president. After graduating from Cornell University in 1909 he spent several years in New England before joining the former Levering & Garrigues Company of New York, where he remained until 1924 when he bought out its contracting department to organize his own company with Edward P. Abbott. Mr. Wigton, long-active in community affairs in Plainfield, N.J., served as its mayor for one term in the 1930's.

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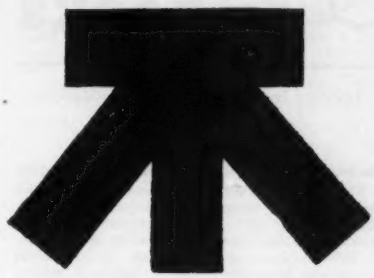

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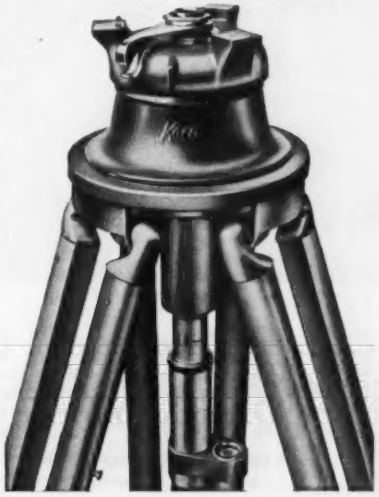


RECENT BOOKS

(added to the Engineering Societies Library)

American Building Art: The Twentieth Century

This volume continues the story of building techniques and structural art begun in "American Building Art: The Nineteenth Century", which was also written by the author, Mr. Condit. It reviews down to the present the profound changes in technology and in American society that have produced meaningful structures. The author assesses such structures as steel frames, the metropolitan railroad terminal, steel truss and girder bridges, steel arch and suspension bridges, concrete building construction, concrete bridges, concrete dams and waterway control, and the metropolitan parkway. (By Carl W. Condit. Oxford University Press, 417 Fifth Avenue, New York 16, N. Y., 1961. 427 pp., bound. $15.00.)

Atomic Energy Waste

This volume reviews the current knowledge concerning nuclear waste products and how they arise. Specifically, it discusses the effects of radiation on materials and living organisms, the legal aspects of atomic energy waste disposal, the operations involved in the treatment of radioactive waste, fission products as sources of radiation, and the uses of radiation in research and agriculture. Each aspect is discussed by a known authority within the respective subject area. (Edited by E. Glueckauf. Interscience Publishers, Inc., 250 Fifth Avenue, New York 1, N. Y., 1961. 420 pp., bound. $14.00.)

The Consulting Engineer

Professional and management problems involved in the practice of consulting engineering are discussed. The first part is concerned with the consulting engineer's professional relationships to his client, to other consultants, and to the public, while the second part deals with internal problems of a consulting practice. It considers the many areas of organization, personnel, plant facilities, procedures, and management situations with which the consulting engineer must cope. Emphasis is placed upon the problems relating to the operation of a consulting practice and not upon the technical problems involved in engineering and design. Sample contracts are appended. (By C. Maxwell Stanley. John Wiley and Sons, Inc., 440 Fourth Avenue, New York 16, N. Y., 1961, 258 pp., bound. $5.95.)

Controle et Essais des Ciments, Mortiers, Betons

This is a synthesis of the results of recent research in France concerning the quality control and testing of various types of "liants hydrauliques"—water-mix bonding elements. The manufacture, classification, physical and chemical properties, and methods of control and of test (both destructive and non-destructive) of various types of cement, concrete and mortar are described, as well as the properties and actions of water, both as a mix and as an environmental enemy. One chapter is devoted to aggregates, and the final chapter to the use of statistical methods. Where applicable new standards of AFNOR (Association française de normalisation) are given. (By Michel Venuat and Michel Papadakis. Editions Eyrolles, Paris, France, 1961. 465 pp., bound. NF 70.05.)

Conversion Factors and Tables

Third Edition

The editors have gathered in one convenient volume a variety of fundamental physical relationships and useful constants for the conversion of units. In this edition every conversion factor has been recalculated on the basis of the latest data available, many new conversion factors have been added, and a number of new tables have been included. Clear, legible type adds to the convenience of the volume. (By O. T. Zimmerman and Irvin Lavine. Industrial Research Service, Inc., Dover, N. H., 1961, 680 pp., bound. $7.50.)

Druckstollenbau

Written in German, this treatment of the construction of pressure tunnels is mainly concerned with the characteristics and design of tunnel linings, both prestressed and otherwise. Several prestressed systems are dealt with. Separate chapters are devoted to formulas and calculations, the risk of roof or wall breakage, test methods, and pressure tunnel statics. (By Alois Kieser. Springer-Verlag, Vienna, Austria, 1960, 218 pp., bound. $12.85.)

Elementary Statics of Shells

Second Edition

A simple and comprehensive presentation of the theory of shells of revolution, cylindrical shells, and shells of general shape. Translated from the German, this work is primarily a graphic study of the spatial interplay of forces in shells. The author's approach permits visual interpretation of equations, and once the basic equations are set down, their results can be interpreted practically in tables and graphs. (By Alf Pflüger. F. W. Dodge Corporation, 119 West 40th Street, New York 18, N. Y., 1961, 122 pp., bound. $8.75.)

Frame Analysis

The mathematical analysis of structural frames is presented. Introductory material outlines the basic concepts of equilibrium, compatibility, and the stress-strain relationship, and describes how they may be used in finding structure problem solutions. This is followed by a discussion of flexibility analysis and stiffness analysis, each of which are shown to be reciprocal approaches to the problem. Several well-known methods are dealt with briefly to illustrate the way in which all other techniques are variants of these two main methods of analysis. Matrix algebra is used extensively. (By Arthur S. Hall and Ronald W. Woodhead. John Wiley and Sons, Inc., 440 Fourth Avenue, New York 16, N. Y., 1961, 247 pp., bound. $8.50.)

Foundation Failures

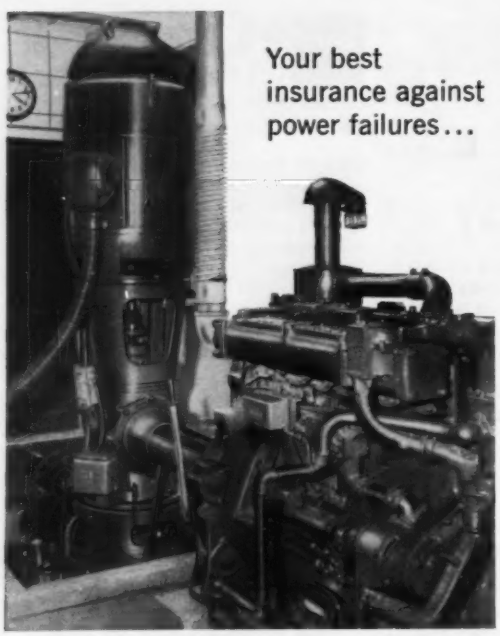
The author discusses the diversity of factors that result in the failure of foundations; and provides guidance on the means by which they can be prevented or remedied. The investigation of the site, unsuitable types of structures and foundations, defects and failures due to defective execution, and failures due to external influences are covered. Most of the failures described have never previously been available in English. The text is illustrated by 102 diagrams and 20 figures, very clearly presented and giving valuable information in addition to the descriptions. (By C. Széchy. Concrete Publications Ltd., London, England, 1961, 141 pp., bound. $5.00. Translated from the Hungarian.)

A Guide to the British Standard Code of Practice for Prestressed Concrete

The British Standard Code of Practice, No. 115, "The Structural Use of Prestressed Concrete in Buildings", was first published in November, 1959, by the British Standards Institution, and deals with the design and construction of prestressed concrete. The present volume is a commentary on this code, with particular emphasis on the recommendations concerned with those aspects of prestressed concrete construction which are not common to other forms of concrete construction. (By F. Walley and S. C. C. Bate. Concrete Publications Ltd., London, England, 1961, 96 pp., bound. $3.00.)

An Introduction to Transportation Engineering

This book has been written to bridge the gap in transportation literature between structural design and economic functioning of the various modes of transport in moving persons and goods, by presenting an elementary study of the technological characteristics of transport systems. The author deals with such topics as the propulsive resistance encountered by all modes of transport and the propulsive force necessary to overcome it, the suitability of a particular mode of transport for a given situation and traffic as determined by operating characteristics, route and traffic capacity as determinants



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of transport utility, and the frequently overlooked factors of terminals, coordination, and operational control. He also discusses the effects of these characteristics of transport systems on costs. (By William W. Hay, John Wiley and Sons, Inc., 440 Fourth Avenue, New York 16, N. Y., 1961. 505 pp., bound. $11.75.)

Nuclear Reactor Containment Buildings and Pressure Vessels

Twenty-two papers and discussions devoted to the analysis, design, construction, and testing of containment buildings and pressure vessels of the type used in nuclear power plants. The papers included were presented at an International Symposium held in Glasgow, Scotland, 1960. (Published by Butterworths, Inc., 7235 Wisconsin Avenue, Washington 14, D. C., 1960. 572 pp., bound. $18.50.)

Past Examinations for Professional Engineer

1961 Edition

This is a compilation of past examinations for Professional Engineer given by the New York State Board of Examiners during the period January 1953 to February 1961. Among the more than 1,000 questions covering all categories are included structural planning and design, basic engineering sciences, and individual categories of engineering. (Compiled and published by John D. Constance, 625 Hudson Terrace, Cliffside Park, N. J. loose-leaf. $1.50.)

Prestressed Concrete Simply Explained

The principles of prestressed concrete are presented in a basic, practical form. Following a discussion of the methods and applications of prestressed concrete, the author covers the materials required, losses of prestress, design of simply supported beams, composite construction, and liquid-retaining structures. An extended section deals with examples of design. (By H. Kaylor. Contractors Record Ltd., London, England, 1961. 158 pp., bound. 28s.)

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Prophet of Progress—Selections From the Speeches of Charles F. Kettering

This fascinating sketch of a prominent engineer is made up principally of his own words. Chronology is a secondary consideration in the chapter arrangement, but the excerpts follow the chronological development of his ideas, showing in most cases a striking consistency indicative of early maturation. Mr. Kettering was a forthright, vigorous thinker, and expressed himself in clear, uncompromising, forceful English. The book also contains personal data such as a short biography and lists of the distinctions awarded him. An inspirational and entertaining book, of wide appeal. (Edited by T. A. Boyd. E. P. Dutton and Company, Inc., 300 Fourth Avenue, New York 10, N. Y., 1961. 252 pp., bound, $5.00.)

Structural Mechanics in the U.S.S.R., 1917-1957

This translation is a review of the results of research carried out in the Soviet Union in the field of structural mechanics from 1917-1957. The nine chapters deal with two- and three-dimensional elastic bar systems; thin-walled members; elastic foundations; the theory of plates; shells, and other thin-walled spatial structures; dynamic analysis of structures; plasticity theory; extremum and variational principles in the theory of structures; and pressure and resistance of granular media; and the analysis of retaining walls and subterranean structures. A bibliography simplified by translation of titles, and transliteration of author-names and sources accompanies each chapter. Also included is the Russian alphabet, the transliteration used in this work, and a list of common Russian abbreviations met in bibliographies. (Edited by I. M. Rabinovich. Pergamon Press, 122 East 55th Street, New York, N. Y., 1960. 431 pp., bound. $8.00.)

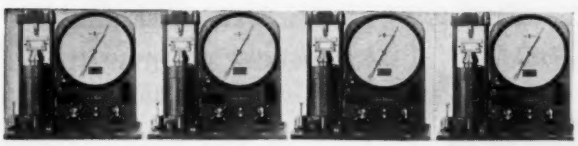
A Survey of the Roads of the United States of America 1789

This volume is a facsimile edition of a work originally published in 1789. It contains maps which trace the major roads of the period from Albany, N. Y., south to Yorktown, Va. Towns, taverns, bridges, churches, and other landmarks are indicated, as well as names of landowners. An illustrated introduction supplies a wealth of information about the maps, the times, and Colles, himself an early American engineer. (By Christopher Colles. The Belknap Press of Harvard University Press, Cambridge, Mass., 1961. 227 pp., bound. $7.50.)

Theory of Elastic Stability

Second Edition

This second edition of a book on the stability of structures emphasizes fundamental theory. The authors have brought their material up to date and added new material on the buckling of bars under the action of non-conservative forces, periodically varying forces, and impact; on the determination of critical loads of columns by successive approximations; on the tangent modulus in the elastic buckling of beams; and on the buckling of plates. (By Stephen P. Timoshenko and James M. Gere. McGraw-Hill Book Company, Inc., 330 West 42nd Street, New York 36, N. Y., 1961. 541 pp., bound. $15.00.)



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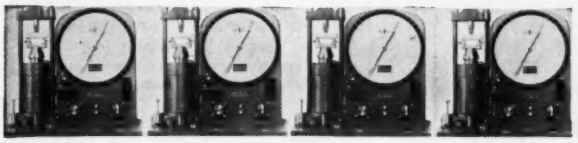

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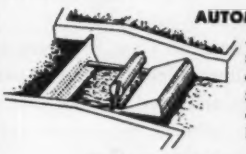

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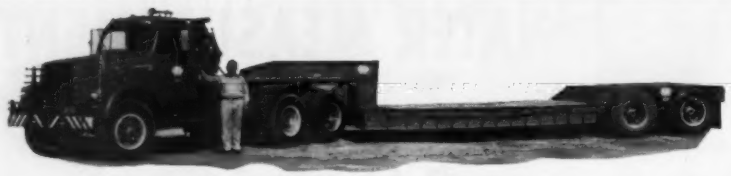

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CIVIL ENGINEER, A.M. ASCE, CE, 32. Ten months in field office with construction company; five years of varied surveying, designing, and construction inspecting on highways. Salary, $650 per month. Se-274.

PROJECT AND CHIEF ENGINEER, F. ASCE, ME, 57. Extensive experience in planning, directing and coordinating engineering for large and small process plants also experienced handling gases, liquids and bulk materials. Location, San Francisco Bay area. Salary, $1,000 per month. Se-1680.

CIVIL ENGINEER AND PUBLIC WORKS ADMINISTRATOR, A.M. ASCE, CE, MS (in personnel administration and training), 46. Twenty years' experience in complete civil engineering planning, design, construction, maintenance of facilities. Location, West Coast. Salary, $12,000. Se-180.

RESIDENT ENGINEER, A.M. ASCE, CE, 31. Over seven years' experience in office design and field supervision of contracted construction and modification of buildings; four years' experience in prebudget planning thru design, material ordering, contract and occasional company force construction, cost analysis; and over one year as division soils engineer, supervising soil investigations and laboratory testing. Some asphalt and concrete testing. Location, West, South United States or Foreign. Salary, $9,500-$12,500. Se-1882.

STRUCTURAL AND CIVIL ENGINEER, M. ASCE, CE, 38. Eleven years in progressively responsible positions in bridge construction, inspection and designing and supervising the design of highway structures including complete planning and layout. Location, Western United States. Salary, $800-$1,000 per month. Se-1717.

ENGINEER, MANAGER, F. ASCE, Registered SE, 72. Forty years in construction and administration, municipal, water supply, irrigation, flood control, waterways, projects, highways, land development, investigations, reports, estimates, costs. Location, West Coast, Foreign. Se-1548.

PROJECT MANAGER, RESIDENT ENGINEER, M. ASCE, CE, 48. Twenty-five years' experience in construction, management in planning, design, maintenance and operation including box culverts, retaining walls, pumping stations, underpass, structures, steel bridges, determine sources of stream pollution. Salary, $10,000. Se-1359.

Positions Available

CHIEF CIVIL ENGINEER with ten to 15 years' experience in heavy or plant construction and five years' specific experience in specifications writing and bid preparation for permanent position with European manufacturer. Will undertake responsibility for the design of a heavy industrial plant to be located in the United States including personal direction of all contracting activities related to project. Applicant must be willing to move to Zurich, Switzerland for one to two years and have some knowledge of German. Moving expenses to Switzerland for initial assignment paid. F-431.

ASSISTANT CITY ENGINEER, civil graduate, preferably with P.E. license; minimum of five years' experience in municipal engineering or related field. Salary, $7,320-$7,680. Tennessee. W-409.

SANITARY ENGINEERS. (*a*) Civil graduate, experienced in preliminary engineering and design of sanitary projects. Registration desirable. Salary, $8,000-$10,000. (*b*) Graduate, to assume overall supervision and client contact on sanitary projects. All phases of sanitary work is desired. Salary, $9,000-$12,000. Company pays placement fee. Iowa. W-374.

ASSISTANT PROJECT SUPERINTENDENTS. (*a*) Graduate civil for construction of 300 MW thermal power plant including coal handling and circulating water systems and all field personnel facilities for two years. (*b*) Civil graduate for construction of 130 MW power station including two turbine-generators each 65 MW and complete circulating water system. Two-year duration. (*c*) Graduate civil for construction of 300 MW thermal power station consisting of four turbine-generators each 75 MW with coal handling and circulating water systems for 30 months. Far East. W-198.

PROJECT SANITARY ENGINEER, CE, registration required, 35-50. Capable of assuming over all supervision of client contact on sanitary projects for a consultant in Iowa. Experienced in all phases of sanitary work desired. Salary, $9,000-$12,000. Sj-6188.

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SANITARY ENGINEER II needed by STATE OF ALASKA

Salary: $840—$1005 per month

THIS POSITION has responsibility for planning program and activities in field of waste disposal and water resources management for State Health Agency. Program content and scope is coordinated with Federal Water Pollution Control activities and takes part in State phase of Federal WPC Construction Grant program. Position is responsible for field surveys and reporting on water quality for the State, for inspection and enforcement in pollution problems on State level and coordinates and consults with local level health agency activities in waste disposal problems.

IT INVOLVES consultation with professional engineering concerns on design and operation of treatment facilities for municipal sewage, industrial wastes, and State and Federal Government installations including facilities for radioactive wastes.

THE POSITION carries out plan review activities for these facilities and should also include promotion for or active research work on special problems.

Requirements: Graduation from college with engineering degree; registered professional engineer eligible for Alaska registration; six years of experience in professional sanitation engineering.

Civil Service Position—Retirement Benefits—Annual and Sick Leave

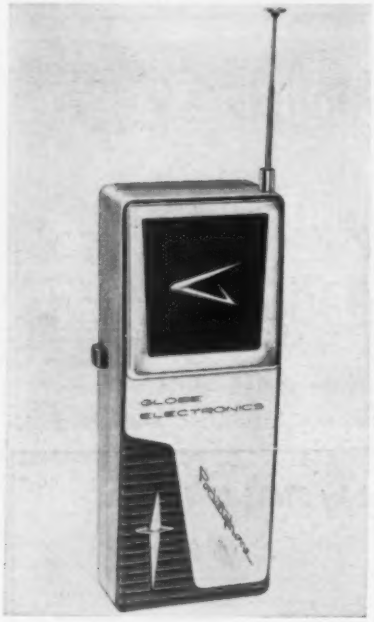
Write AIR MAIL to: Personnel Officer
Alaska Department of Health and Welfare
Alaska Office Building
Juneau, Alaska

EQUIPMENT, MATERIALS and METHODS

NEW DEVELOPMENTS OF INTEREST AS REPORTED BY MANUFACTURERS

Miniature Two-Way Radio

CALLED THE "POCKETPHONE", this little 1⅝" x 2⅜" x 6¼" hand radio, broadcasts and receives at distances up to one mile. Weighing only 13½ oz, the radio is already finding many uses as a paging system, for business or personal uses, in factories, oil fields, warehouses, department stores, stockyards, hospitals and



Pocketphone

Civil Service employees. The transistorized radio is 100% portable with built-in "Power-Pak" battery that may be recharged and will last up to one year without replacement. Microphone and speaker are built in and a retractable antenna may be extended for broadcasting. **Globe Electronics Div., G. C. Electronics, CE-7, 400 W. Wyman St., Rockford, Ill.** Note: This item was last run in the May issue with an incorrect address.

Aluminum Coating

AN ALUMINUM COATING, called "Perma-Cote 61", gives aluminum, other nonferrous metals and stainless steel full protection against acids, alkali and outdoor exposure. It is a colorless, non-yellowing coating which forms a tough, glossy film that will not discolor when exposed to ultraviolet rays. The new product also possesses adhesive qualities and can be economically applied by dip, brush or spray. The coating dries tack-free in two to three minutes at room temperatures and 50 percent relative humidity. **Service Products Division, Johnson's Wax, CE-7, Racine, Wisconsin.**

Crawler Mounted Rock Drill

A CRAWLER-MOUNTED rock drill, designated the TDM-B1, has remote controls and a flexible swinging boom design, which permits hydraulic positioning of the feed and drill to put down holes in a lateral arc 45 deg from center. New features include full-range power positioning which permits changing from vertical to horizontal drilling without manual adjustment of the feed; drilling controls that are mounted on an arm that swings with the boom, yet may be adjusted to vary the distance between the drill and the operator; and an automatic hose reel which keeps the hoses aligned and out of the way. The chassis for the TDM-B1 is of extra-rugged construction with a total of 23 hp for tramming. Hydraulic power handles all positioning of the drill and feed, with up to 12 ft steel changes. **Joy Manufacturing Co., CE-7, Henry W. Oliver Building, Pittsburgh 22, Pa.**

Pocket Record Book

THE DAY-TIMER is a simple five-in-one record book designed as a tool for better utilization of executive and professional time and talent. This is not to be confused with complicated record keeping and bookkeeping systems which might require batteries of forms and record books. It fits easily into the record-keeping systems of large or small firms—whether or not billing is on the basis of time and service. This book acts as a daily, weekly, monthly work planner, reminder, time record, daily appointment book and permanent record of activities. Information is available for either the Day-Timer loose-leaf style or the Pocket Day-Timer file. **Day-Timers, CE-7, Allentown, Pennsylvania.**

Expansion Joints

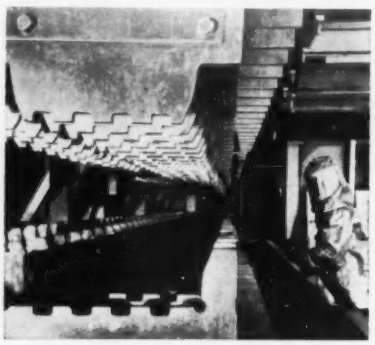
EXPAND-O-FLASH is a combination of time-proven construction materials fabricated in lengths for fast, economical installation in the field. Lengths may be quickly joined together to form uninterrupted spans or joined to prefabricated corners or crossovers. The resilient neoprene rubber strip, joined to the metal edging with a combination mechanical/adhesive bond, provides the required flexibility together with the lifetime qualities of weather-resistant metals. The specially compounded neoprene sheet used in this material has the qualities of natural rubber-resilience, abrasion resistance, low compression set—plus flame retardance and low permeability—and retains these properties under exposure to sunlight and weather, ozone and oxygen, oils and greases, heat and chemical attack. **Lamont & Riley Co., CE-7, 300 Southwest Cutoff, Worcester 7, Mass.**

Abrasive Disc

A NEW FIBER-BACKED abrasive disc, for lighter grinding operations, is employed with a unique abrasive grain-resin bond system making this disc an extremely sharp, fast-cutting product with unusual resistance to loading and controlled breakdown of the abrasive coating. A clean chip-free edge is obtained when the used discs are cut down to smaller diameter. Tests show superior performance on stainless steel grinding, steel panel spotting and repair, non-ferrous alloys and blending operations involving solder or plastic fillers. It is available in an aluminum oxide grit range of 24 grit through 50 grit. **Advertising Branch, The Carborundum Company, CE-7, P.O. Box 337, Niagara Falls, New York.**

Structural Steel Shapes

ROLLED STRUCTURAL SHAPES made from quenched and tempered alloy steels which are heat treated to design strengths as much as three times that of structural carbon steel are furnished in standard I-beams, channels and angles, and in lengths up to 40 ft. The new shapes are produced from quenched and tempered alloy compositions which include: USS "T-1" and "T-1" type A constructional alloy steels; 9% nickel steel for cryogenic applications at temperatures as low as —320 deg F; and HY-80 naval armor



Waterquenching Process

steel. Designers can now specify off-the-shelf shapes of "T-1" steel which have a minimum yield strength of 100,000 psi, about three times that of structural carbon steel. These shapes have the same toughness and excellent weldability as "T-1" steel plates. Foreseen are major markets for the constructional alloy steels in two distinct areas. One will include machinery and equipment, especially mobile types, while the second will include stationary structures. **United States Steel Corp., CE-7, 525 William Penn Place, Pittsburgh 30, Pennsylvania.**

Side-Dump Truck

THE DUMPCRETE SIDE-DUMP mounts on a standard truck chassis, requires no outriggers, and drives parallel to the forms with no backing or angling of truck. Electric cab controls permit driver controlled fast discharge of a 12 ton (6 cu yd) load in 45 sec from truck stop to truck go, with no dumpman or spotter required. It

Dumpcrete Side-Dump

features: discharge of concrete with no segregation, clean discharge of lowest slump concrete, and the ability to haul sand, gravel, base coarse materials and excavation. The complete hydraulic system incorporates cylinders, reservoir, valves, hose lines, pump, electric cab controls and three position valve controls for body and gate. Construction is of all-welded, high tensile steel, all surfaces are smooth with corners rounded. **Maxon Construction Co., Inc., CE-7, 2600 Far Hills Avenue, Dayton 19, Ohio.**

Ball Valve

AN ENTIRELY NEW CONCEPT in ball valve design featuring major improvements in sealing characteristics, compact one-piece forging, and built-in union ends which simplify installation, operation, and maintenance has been achieved through the Petro Ball Valve. Engineered for rapid installation and fast disassembly for maintenance, the valve is designed to control flow of liquid or gas in petroleum, chemical, food processing and a wide range of industrial piping systems. The principal advantage of the valve is the dual seat, where the ball, floating between the seats, makes a tighter seal as it is forced against the downstream seat by increasing pressure. The pressure at the upstream seat is then equalized by permitting the fluid to get behind the upstream seat. **Forged Steel Products Division, CE-7, 1900 Dempster Street, Evanston, Illinois.**

Correction

ITEM #94-Grain Storage, listed in the Catalog Digest section of the April issue was incorrectly stated as costing $.75. This booklet is offered free by the **Behlen Mfg. Co. Inc., Metal Building Div., Columbus, Nebraska.**

For Better Doors, EVERYTHING POINTS To Kinnear . . .

For the extra advantages of coiling, interlocking-steel-slat action **(originated by Kinnear)** —and . . .

. . . for doors that open **completely** out of the way . . .

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. . . for doors that often deliver 30, 40 — **even 50 or more** years of low-cost service . . .

. . . for heavily galvanized doors that give many **extra** years of corrosion-free service . . .

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adds:
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No swinging, swaying plumb bob!

The advantages of the Optical Plummet have now been added to a construction transit by Gurley. Model OP-207 is the latest addition to the line of *American-made* precision instruments for the Contractor, Engineer, Architect and Builder.

The Optical Plummet Transit can be set up in less time—at least one third. Accuracy is improved by sighting precisely on the point beneath the transit; and set-up time is much reduced.

The Optical Plummet is a telescope through the vertical center (spindle) of the transit. It points vertically when transit plate is level.

Features: The Gurley Optical Plummet telescope may be focussed from about 12 inches—for set-ups over high construction stakes—to *infinity*, for use over points far below tripod height, such as trenches, steelwork or deep excavation. To maintain verticality during the centering process, the Gurley *Shifting Head* Tripod provides not only a constant level, but approximately 1¾″ of shift.

Gurley stiff-leg (or extension-leg) Shifting Head Tripod is supplied with the instrument.

See your Gurley dealer or *write for Catalog 250 describing the complete line of Instruments for the Contractor.*

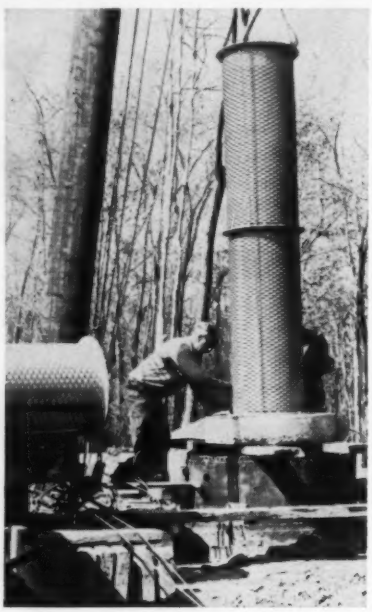
W. & L. E. GURLEY
518 Fulton Street, Troy, N.Y.

EQUIPMENT MATERIALS and METHODS

(continued)

Stainless Steel Used for Water Well Screen

New England's largest water well, which has a capacity of 5,000,000 gpd, features the use of stainless steel screens. Such screens, now being made of the Allegheny Ludlum Steel Corporation's stainless steel perforated plate, are used to screen sand and small stones. In this well, six 5-ft sections were bolted together and



Stainless Steel used for Well Screen

lowered to the bottom of the 72-ft well. Each section weighs 240 lb. Such screens have withstood driven pressures of 40 to 50 tons. Another advantage is their resistance to corrosion, which provides estimated savings of 35 to 40 percent over well screens previously used. Photo courtesy of "Nickel Topics." **The International Nickel Co., Inc., CE-7, 67 Wall Street, New York 5, N. Y.**

Table-Top Drafting Machine

THE PARAGON JR, a compact, desk and table-top drafting machine, combines the drawing capabilities of a T-square, straightedge, triangle, scale and protractor. It features controls that permit one-hand operation. It operates on any drawing board inclined at any angle up to 20 deg and will accept any scales with standard chuck plates. The control head has full 360 deg indexing with automatic 15 deg stops, a rapid release for intermediate settings, and a convenient lock for intermediate setting of the protractor and vernier. **Keuffel & Esser Co., CE-7, Third and Adams Streets, Hoboken, N. J.**

POSEY

TUNNEL FORMS

Adjustable box forms for 13′x9′, 11′x9′, 8′x8′, and 6′6″x6′6″ sewers. Also round forms, air locks, jumbos, head frames and other tunnel equipment.

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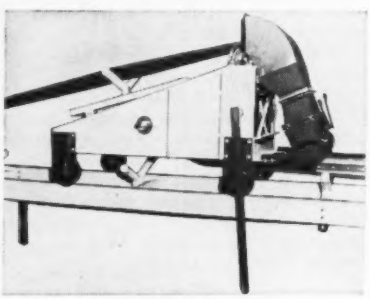
• Tunnel Forms • Industrial Heating • Foundry
• Large OD Steel pipe

102 South Street LANCASTER, PA.

Versatile Tripper

THIS BELT PROPELLED TRIPPER weighs 762 lb, completely reversible and spots the conveyed commodity at any point in a material handling system. The tripper can be easily set up for automatic stock piling. It can accommodate belt sizes from 12 to 24 in. Discharge arrangements are available including a 3 way spout.



Belt Propelled Tripper

When it is used with Dual Roll Idlers (Rabbit-Ears) capacities of 265 tons per hour (material weighing 100 lb cu ft) can be obtained at 300 ft per minute belt speed. **Finco Inc., CE-7, 525 Rathbone Avenue, Aurora, Illinois.**

EQUIPMENT MATERIALS and METHODS

(continued)

Dragline-Clamshell

A DIESEL-ELECTRIC DRAGLINE AND CLAMSHELL Model 210-B can handle buckets up to 10 cu yd, with boom length of 100, 120 and 140 ft. A key feature is the elimination of friction clutches for all cyclic functions. Hoist and drag or holding and closing motions are regulated by a static type of control of independent electric eddy current clutches, which are

Crawler-Excavator

liquid cooled by a radiator system. The swing motion is controlled by a variable Ward Leonard system. Positive lubrication of gears and bearings is provided by oil pumps. Unitized construction facilitates assembly and assures correct lineup of shafts and bearings. **Sales Promotion Div., Bucyrus-Erie Co., CE-7, South Milwaukee, Wisconsin.**

Hi-Lo Boom Unloader

THE SIDE-O-MATIC Hi-Lo boom unloader combines the advantage of a crane and a fixed-boom unloader. When the boom is raised to its maximum angle of 60 deg from the horizontal, a clearance of 20 ft is provided from the bottom of the fork to the ground. With the boom raised to its highest position, the diameter of the unloading circle is reduced to 16 ft, allowing cube placement in narrow alleys or other tight areas. In the horizontal position, the boom offers a reach of 17 ft 5 in. from the center of the mast to the center of the load. It has a maximum capacity of two tons and will rotate continuously through 365 deg in either direction. A push-button switch box gives remote control of both boom elevation and rotation. **Side-O-Matic Unloader Corp., CE-7, P.O. Box 1561, York, Pa.**

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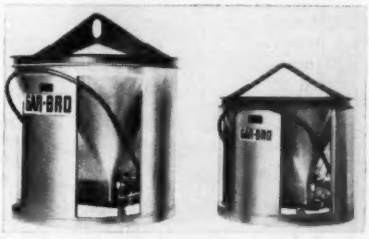
Vertical Center Discharge

IMPROVED CONCRETE BUCKETS, featuring extra large double clamshell gates, are designed especially for handling lower slump concrete. These buckets have steep side slopes to accommodate stiffer concrete and low loading heights which make it possible to load buckets up to and including the 2 cu yd size from most ready-mix trucks. Vertical center discharge prevents segregation of concrete mix and the patented, extra-large

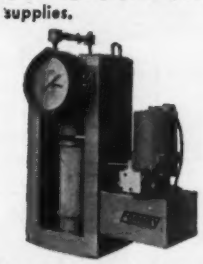


double clamshell gates are non-jamming and grout-tight. Large gear teeth and self-closing springs assure easy gate control. The buckets come in eight sizes ranging from ⅓ to 4 cu yd rated capacity. These buckets are normally equipped for manual gate operation, but air-operated gates and remote control for underwater placing are available. **Gar-Bro Manufacturing Co., CE-7, 2415 East Washington Blvd., Los Angeles 21, California.**

FORNEY CONCRETE TESTERS

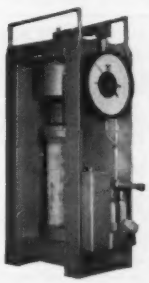
meet the exacting requirements of the construction industry's concrete testing applications.

Forney engineers are proven specialists in the concrete testing equipment field. For eleven years they have furnished the industry with quality testing equipment, accessories and supplies.



MODEL FT-30 HEAVY-DUTY PORTABLE CONCRETE TESTER

Latest addition to a complete line of portables, the FT-30 brings laboratory performance right to the job site. Self-contained power unit eliminates cumbersome hose and manual pumps. Loading speed is completely variable for accurate conformance to current ASTM standards.



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- **250,000 lb. load rating**
- **Designed to protect operator from flying fragments**
- **Fully protected gauges equipped with instant connectors**

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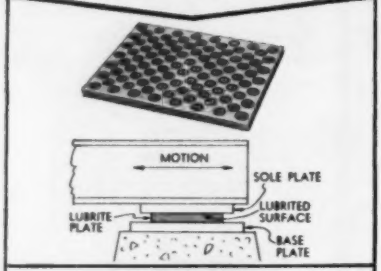

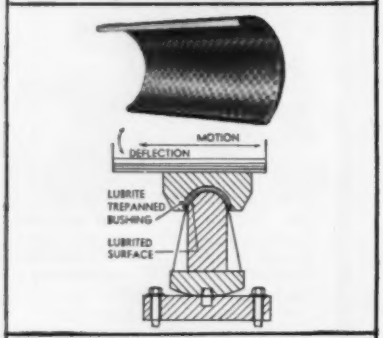

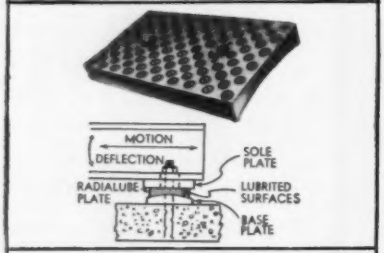

When expansion, contraction and/or rotation of structural members are factors in the design of any bridge, overpass, building or other construction, Lubrite offers many distinct and important advantages. Specifically Lubrite permits the use of simplified designs, cuts construction costs substantially, virtually eliminates maintenance and offers a low coefficient of friction. Assure better results, longer life and unequalled performance — specify Lubrite — over 50 years of success "where others have failed"

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LUBRITE DIVISION
MERRIMAN BROS., INC.
193 Amory Street, Boston 50, Mass.

EQUIPMENT, MATERIALS and METHODS

(continued)

Compact Tape Recorder

A COMPACT 2-SPEED miniature transistor tape recorder has been designed as small as a book and easily portable. The Model TR-403, as it is called, records up

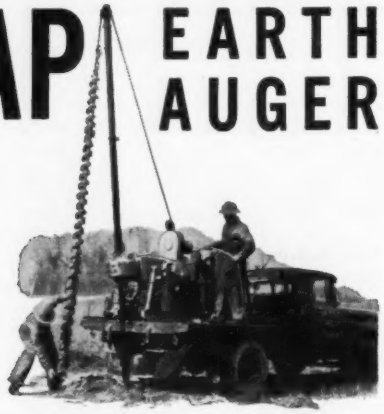
TR-403 Recorder

to 68 minutes on one tape. A V-U meter provides for checking recording level and battery condition while operating and standard penlight batteries supply its power. The recorder is fully equipped with microphone and case, reel case and earphones. Available accessories include a foot switch, telephone pickup and AC adapter to convert battery power to standard 115V AC. **Craig Panorama, Inc., CE-7, 5290 West Washington Blvd., Los Angeles, California.**

Porta Splitter

THE PORTABLE SAMPLE splitter halves and quarters samples of about ½ cu ft in sizes from sand up to 2 in. aggregate. The main features are a loading hopper that permits hand levelling of the sample to be divided, and an adjustable universal splitter chute which provides quick and accurate selection of a variety of chute openings. It is durably made of heavy welded steel and is small enough for convenient transport in an auto trunk. The universal chute consists of a series of aluminum or plated steel bars with a locating rod passed through their lower ends. Chute widths are easily selected by manipulation of the bars, which are then locked in place. The equally divided sample flows into two material pans located on either side of the chute. **Gilson Screen Company, CE-7, 110 Center Street, Malinta, Ohio.**

ACKER AP EARTH AUGER



The world's most versatile soil sampling rig

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- Developing Rock Profiles
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- Locating Borrow Pits
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dozens of other applications

You can obtain accurate sub-surface information with the remarkably versatile Acker Earth Auger. Its design and built-in features permit speedy earth sampling with either large diameter single flight or continuous flight augers. The patented hydraulic head permits pressing samples or coring with diamond or inexpensive shot core bits. A rugged built-in hoist is handy for driving casing, doing standard penetration tests, or hoisting operations.

Whatever your soil sampling requirements may be, chances are, that this inexpensive, portable earth auger will do it better! You'll be surprised at the capacity and price of this incomparable rig!

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Over 40 years of experience manufacturing a complete line of diamond and shot core drills, accessories and equipment.

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LOW-COST AUTOMATIC FLOW RECORDING

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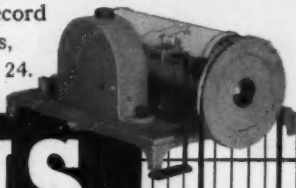
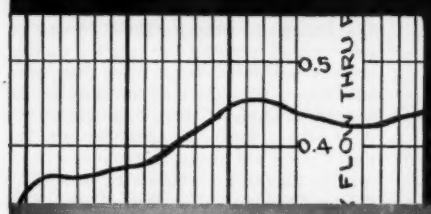
Obtain graphic records of liquid flow directly readable in million gallons per day or gallons per minute over various sizes of Parshall flumes. The same recorder can also be used with charts reading in feet and hundredths to record head or surface fluctuations in lakes, streams, wells. Write for free Bulletin 24.





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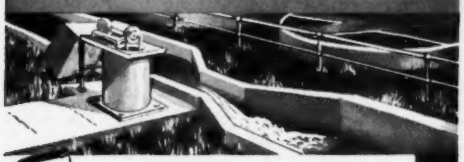
TYPE F RECORDER

...For Measuring Sewage, Industrial Waste and Other Flows



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As a project of the Committee on Structural Dynamics of the Engineering Mechanics Division, through its Manual Subcommittee this Manual (No. 42) has been in preparation for several years. It was written for use of the engineering profession in the design of structures which are intended to be resistant in some degree to all of the effects associated with the detonation of a nuclear weapon. Copies of this paper-bound Manual can be obtained by completing the accompanying coupon. The list price is $4.00 and ASCE members are entitled to a 50% discount.

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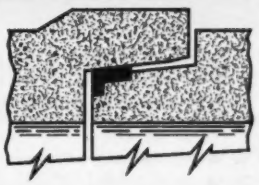

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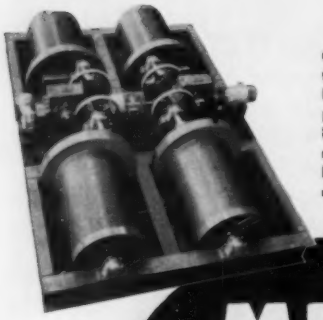

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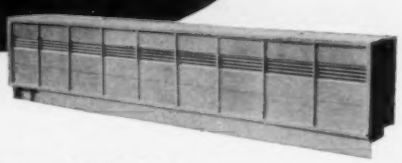

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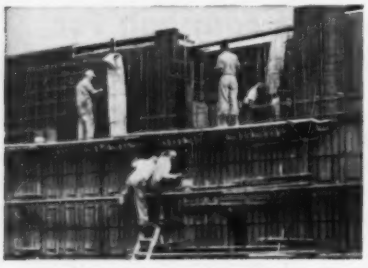

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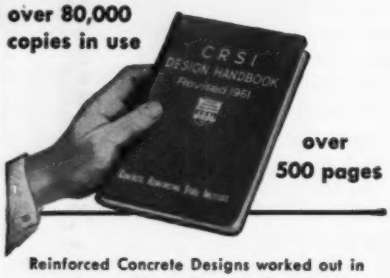

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36 IDEAS FOR BRIDGES—American Bridge has made available an additional "36 Ideas for Tomorrows Short Span Bridges" that came from the competition in bridge design for which $44,000 in cash prizes was awarded. This 80-page, well illustrated, brochure supplements a booklet covering the 15 winners. These 36 entries were chosen from the 300 received on the basis of individual design ideas they contain. Overall weight, cost or appearance may make some of them impractical but they have contributed ideas for the future. Copies are available to those with a real use for them on request to: **American Bridge Division, U.S. Steel Corp., 525 William Penn Place, Pittsburgh, Pennsylvania.**

ANNUAL PUBLICATION—The 13th edition of the compendium of unit prices on various types of contracts, on which bids were invited through the Northeastern Area during 1960, is now available. Two or three of the lowest bids are listed for each project, in their entirety. **The Aetna Casualty and Surety Company, CE-7, Hartford 15, Connecticut.**

DRAFTING TAPE—A 27-page catalog offers descriptions and specifications on various types of drafting tapes. The tape, with adhesive backing, comes in a dispenser for easy use. For drafting, layouts, reproductions, etc. the convenience of different colors, sizes and designs provide for neater copy and a probable reduction in time. **Chart-Pak, Inc., CE-7, Leeds, Mass.**

DAM CASE STUDIES—Pozzolith's role as a concrete improving admixture in providing durability, strength and economy features 25 reports on major dams built in the United States, Japan, Canada, Alaska and South America in the 48-page publication, MBR-P-3. **The Master Builders Company, CE-7, Cleveland 18, Ohio.**

HOLLOW STRUCTURAL TUBING—Design data on steel tubing as economical structural components are available in handy 8½ x 11 folder giving mechanical and physical properties of these efficient structural numbers. Square sizes of tubing range from 1 in. to 10 in. sq. with wall thickness up to ½ in.; rectangular shapes up to 10 x 6 in. All sizes are manufactured in A-7 and A-36 steel. Mill tolerances are given with the handbook data needed by the designer for fast plan preparation. **National Tube Division, United States Steel Corp., CE-7, 525 William Penn Place, Pittsburgh 30, Pa.**

LUBRICATION RIGS—A catalog describing these Portable Lubrication Rigs with specifications for all trucks or trailers concerning the designing, engineering and building of this equipment is now available. **The Cypher Company, CE-7, 1201 Washington Blvd., Pittsburgh 6, Pa.**

Literature Available

ECONOMICS OF ASPHALT AND CONCRETE—A summary report prepared by the Stanford Research Institute has come to the conclusion that asphalt paving holds a substantial economic advantage over portland cement for use on mainline highways. This project compared the two pavements by combining: initial cost, resurfacing cost, annual maintenance cost, time to first resurfacing and interest on the capital investment. **American Petroleum Institute, CE-7, 1271 Avenue of the Americas, New York 20, N. Y.**

NEW PRODUCTS BULLETIN—A 12-page bulletin on devices for testing soil, concrete, bituminous materials and similar construction materials is fully illustrated. Included are a new soil volume change meter being specified for soil testing by the Federal Housing Authority; the mechanical laboratory compactor for soils; compression testing devices and a new line of motorized sieve shakers. **Soiltest, Inc., CE-7, 4711 W. North Avenue, Chicago 39, Illinois.**

LIFETIME VITRIFIED CLAY PIPE—This illustrated booklet contains a list of specifications applicable to clay products, including those of ASTM, ASA, AASHO and U.S. Government. Information on clay processing, basic clay products, developments in factory-made pipe joints, typical characteristics of clay pipe, typical uses of clay pipe, and a report on research being conducted to develop better clay products, is also included. **National Clay Pipe Mfgrs., Inc., CE-7, 1026 Connecticut Ave., N.W., Washington 6, D.C.**

KEY TO SMOLEY'S—is beneficial to all users of the C. K. Smoley's engineering tables. Many owners and users of these tables do not fully understand all the sections and methods available in them. The simplified "key" teaches the working of the tables in a relatively short time. It contains graphic examples, solutions and their respective application to the tables. **George F. Wolters, CE-7, P. O. Box 475, Ormond Beach, Florida.**

SLUICE GATE—This 212-page catalog presents a full line of sluice gates and auxiliary water and sewerage control equipment. It covers more than 3,000 combinations of types and sizes of sluice gates, as well as hoisting equipment, fabricated gates of metal and wood, valves, regulators, etc. **Rodney Hunt Machine Co., CE-7, 661 Lake St., Orange, Mass.**

CRYOGENIC STORAGE VESSELS—This brochure describes vessels designed to store liquefied petroleum gases at extremely low temperatures. It describes the design of double wall storage vessels, their refrigerating systems and accessories. Illustrations include drawings and photographs of several cryogenic storage facilities built by **Chicago Bridge & Iron Co., CE-7, 332 So. Michigan Avenue, Chicago 4, Ill.**

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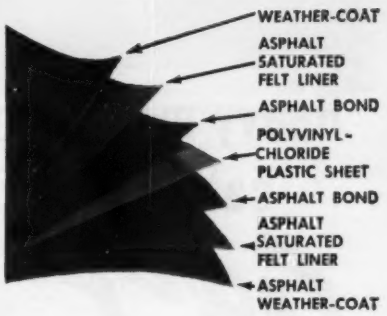

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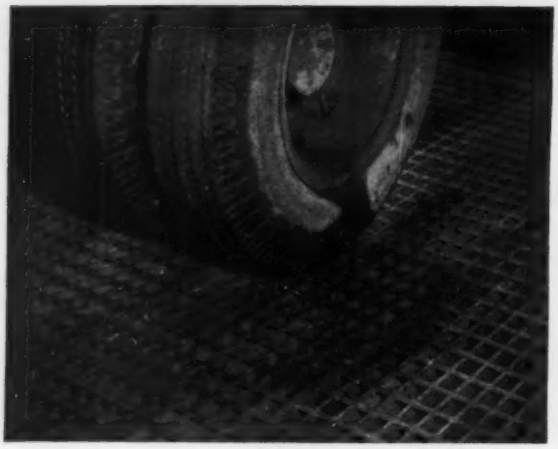

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From the MANUFACTURERS

NEW OFFICES: The New York and Philadelphia offices of John A. Roebling's Sons Division, The Colorado Fuel and Iron Corporation, are located in a new office and warehouse at Adams Station, New Jersey . . . The new headquarters for Security Valve Company, a subsidiary of Menasco Mfg. Co. was recently dedicated in South Pasadena, Calif. . . . United States Pipe and Foundry Co. has opened a new sales office in Buffalo, N. Y. . . . C. H. Wheeler Mfg. Co. has established a Western Regional Sales Office in San Francisco, Calif. . . . **PUBLIC RELATIONS:** Crane Co. will open an International Panorama-of-Products Showroom in New York . . . Chrysler Corporation's Airtemp Div. sponsored a national telethon, which accounted for sales in air conditioning and heating equipment from distributors to dealers . . . The Amerada Glass Corp. has announced a comprehensive national advertising, public relations and merchandising program to create a demand for laminated architectural glass . . . AWARDS: Aerojet-General Corp's AETRON Div., was awarded a $4.8 million NASA contract for additional work on the Saturn static test facility at the G. C. Marshall Space Flight Center . . . The Eimco Corp. has won the "Blue Ribbon Mining Award" for achievement in equipment development aiding the technological advancement of the mining industry . . . Atlas Copco has been selected to receive an award in the Mining World-World Mining Annual Blue Ribbon Equipment Awards Contest . . . **NEW FIELD:** Don Clair and Dick Goff have formed an advertising agency organization to be known as Clair & Goff Associates, Inc. . . . Consolidated Pipe Co. of America has marketed two new plastic conduit products, marking its entrance into the electrical conduit field . . . **EXPANSION:** Linde Company, Div. of Union Carbide Corp., is planning a $2.5 million expansion and modernization of its manufacturing facilities in Tonawanda, New York . . . A new sewage treatment plant, the Model R "Oxigest" has been added to the line at Smith & Loveless, Div.-Union Tank Car Co. . . . A 13,000 sq ft addition has been completed by J. T. Ryerson & Son, Inc. at its Seattle, Wash. steel and aluminum service plant . . . **NEW NAME:** The Nichols Filtration, Refuse and Incinerator and Sewage Sludge Div. have been consolidated into a Public Works Equipment Div. . . . Smith Welding will become a division of Tescom Corp. as will a new Fluid Systems Div. . . . WATUBO Industries is the new corporate name for Water Tube Boiler & Tank Co. . . . **MERGER:** Atlas Chemical Industries, Inc., announced the merger with the Stuart Company . . . **ACQUISITIONS:** Fairbanks, Morse & Co. has purchased the assets of the Herold Radio and Electronics Corp. . . . Barrett Div. of Allied Chemical Corp. has acquired two plants in the Dayton area . . . **AGREEMENTS:** Champion Mfg. Co. has entered into an exclusive agreement with Tubular Structures Co., covering distributing sales and service of Simba, Tusky and Jumbo hoists in all but eleven Western states and Canada . . . Harnischfeger Corp. and John Inglis Co., Ltd. representing the U. S. and Canada have signed a long term agreement which will increase availability of construction and mining equipment and replacement parts in Canada . . . **APPOINTMENTS:** Gar Wood Industries announces the appointment of Baton Rouge Equipment Co., Inc. as dealer for their full line of Buckeye Ditchers, Spreaders and Finegraders . . . Welch, Inc. has become a member of the National Association of Architectural Metal Manufacturers and of the Store Front and Entrance Div. of NAAMM . . . Jessop Steel of Calif. has been appointed a distributor of Olin Aluminum mill products . . . R. A. Beals has been named manager of the Commercial & Industrial Div. of the National Better Heating-Cooling Council . . . R. W. Tomlinson has been appointed manager of purchases of the Alpha Portland Cement Co. . . . B. R. Wellek was appointed assistant director, advertising and public relations for The Master Builders Co. . . . R. Ifould has been appointed company sales rep. for Western Europe by the Ridge Tool International Co., Inc. . . . H. T. Larmore has been appointed assistant general manager, Allis-Chalmers Construction Machinery Division.

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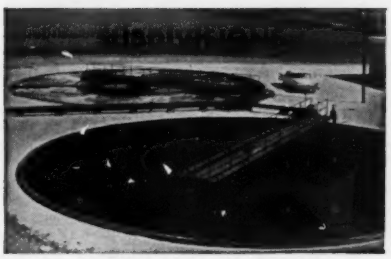

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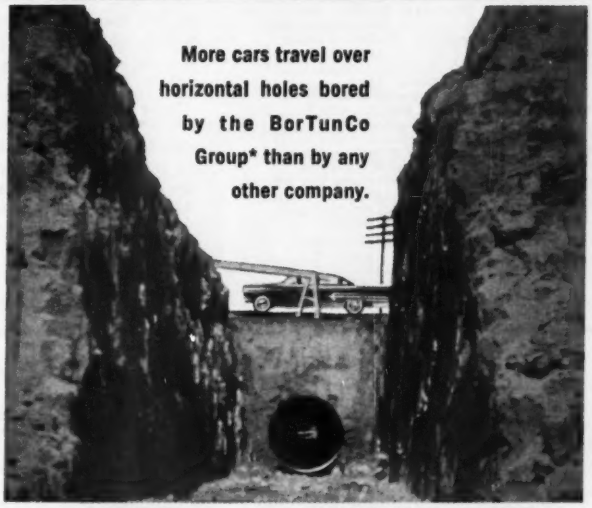

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NON-ASCE MEETINGS

American Association of State Highway Officials. Regional conference on improved highway engineering productivity, co-sponsored by the Bureau of Public Roads, the Massachusetts Department of Public Works and engineering schools in the metropolitan Boston area, at the Somerset Hotel, Boston, Mass., August 24 and 25, 1961.

American Society of Mechanical Engineers—American Institute of Chemical Engineers. Co-sponsors of the International Heat Transfer Conference at Boulder, Colo., August 28-September 1, 1961.

American Standards Association. Twelfth national conference on standards at the Rice Hotel, Houston, Texas, October 10-12, 1961.

American Welding Society. Fall meeting at the Adolphus Hotel, Dallas, Texas. September 25-28, 1961.

Institute of Traffic Engineers and International Sessions in Traffic Engineering. World Traffic Engineering Conference, combined meeting in Washington, D.C., August 21-26, 1961.

International Association for Hydraulic Research. Ninth congress in Belgrade, Yugoslavia, September 3-7, 1961. Write to H. J. Schoemaker, c/o Waterloopkundig Laboratorium, Raam 61, Delft, Netherlands.

National Bituminous Concrete Association. Midyear meeting at the French Lick-Sheraton Hotel, French Lick, Ind., July 23-25, 1961.

National Science Foundation—Langley Research Center of the National Aeronautics and Space Administration. A conference on physics of the solar system and reentry dynamics at the Virginia Polytechnic Institute, Blacksburg, Va., July 31-August 11, 1961.

National Society of Professional Engineers. Twenty-seventh annual meeting at the Olympic Hotel, Seattle, Wash., July 4-7, 1961.

Soil Conservation Society of America. Sixteenth annual meeting on the campus of Purdue University at Lafayette, Ind., July 30-August 2, 1961.

Water Pollution Control Federation. Thirty-fourth annual meeting in Milwaukee, Wis., October 8-12, 1961. Headquarters will be the Hotel Schroeder.

Western Resources Conference. Third annual conference sponsored jointly by the University of Colorado, Colorado State University, and the Colorado School of Mines in the Engineering Auditorium at Colorado State University, Fort Collins, Colo., August 7-11, 1961.

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PROCEEDINGS AVAILABLE

June

Journals: Irrigation and Drainage, Engineering Mechanics, Highway, Soil Mechanics and Foundations, Structural.

2828. Impact Waves in Sand: Theory Compared with Experiments on Sand Columns, by Blaine R. Parkin. (SM) A one dimensional theory of elastic-plastic wave propagation in a strain-rate sensitive material is compared with published experimental results on impact wave propagation in dry Ottawa and Fort Peck sands.

2829. Attenuation of Stress Waves in Bi-Linear Materials, by Richard Skalak and Paul Weidlinger. (EM) The attenuation of plane stress waves generated by a decaying surface pressure in a bilinear medium is studied.

2830. Viscoelastic Winkler Foundation with Shear Interactions, by Arnold D. Kerr. (EM) The concept of the Pasternak-foundation, consisting of the Winkler-foundation with shear interactions, is extended to the case of viscoelastic behavior.

2831. Field Measurement of Hydraulic Conductivity, by William W. Donnan and V. S. Aronovici. (IR) A small-diameter well point that has been developed for use in the field to measure the hydraulic conductivity of sand strata is examined.

2832. Uncertainties, in Earth Dam Design, by John M. Bird. (SM) Some of the uncertainties that enter into embankment design and the methods used in the designs by the Corps of Engineers, U. S. Army, at the Terminus and the New Hogan Projects are presented herein.

2833. Intergrated Parkway and Expressway Planning, by D. Jackson Faustman. (HW) Design concepts of intergrating parking and expressway planning are studied.

2834. Outlook for Economic Use of Fresh Water from the Sea, by Samuel B. Morris. (IR) A study of the supply and demand of fresh water from the sea in relation to the cost of production, storage, and transportation is presented.

2835. Ultrasonic Evaluation of Reinforced Plastics, by Albert G. H. Dietz. (EM) Nondestructive means of evaluating composition and quality of structural reinforced plastics are analyzed.

2836. Unsteady Flow of Ground Water into Drain Tile, by R. H. Brooks. (IR) A solution to the nonlinear differential equation describing unsteady flow toward equally spaced drains above a horizontal impermeable boundary is presented.

2837. Water Table Fluctuations Induced by Irrigation, by Marinus Maasland. (IR) The theory of intermittent recharge as previously developed is extended and analyzed.

2838. Geophysics Efficient in Exploring the Subsurface, by R. Woodward Moore. (SM) Two Geophysical methods, refraction seismic and electrical resistivity, are described and examples of their application to subsurface problems are presented.

2839. Discussion of Proceedings Paper 1826, 2216, 2431, 2522, 2618, 2626, 2746. (SM) Committee on Glossary of Terms and Definitions in Soil Mechanics and Foundations Division on 1826. H. B. Seed and C. K. Chan on 2216. D. H. Trollope and C. K. Chan on 2341. James K. Mitchell on 2522. Edward F. Lobacz on 2618. Aleksandar B. Vesic on 2626. K. Y. Lo and M. Arnold on 2746.

2840. Discussion of Proceedings Paper 2530, 2671, 2672, 2673. (IR) Charles W. Thomas on 2530. William H. Donnan and Charles H. Lee on 2671. George H. Hargreaves on 2672. Vahe J. Sevian and Kamil Taj-Eddin on 2673.

2841. Discussion of Proceedings Paper 2412, 2417, 2677. (HW) Ira B. Mullis on 2412. William R. McCononchie on 2417. William Zuk, Howard Newlon, Jr., R. A. Mitchell, and Bengt F. Friberg on 2677.

2842. Discussion of Proceedings Paper 2516, 2575, 2578, 2629, 2627, 2343, 2445, 2498, 2686, 2688, 2690, 2748. (EM) Melvin L. Baron and Mario G. Salvadori on 2516. Ernest T. Selig, Keith E. McKee, and Eben Vey on 2575. Raymond A. Hill on 2578. Enno Penno on 2624. A. Assur on 2627. G. N. Bycroft on 2343. Manuel Stein on 2445. George E. Mase on 2498. H. L. Sujata and Hans Conrad on 2686. S. K. Ghaswala on 2688. Le-Wu Lu on 2690. Glenn B. Woodruff on 2748.

2843. Philosophical Aspects of Structural Design, by Hsuan Loh Su. (ST) Presented herein are some philosophical aspects of structural design, such as the concept of safety, differences between the required and the available safety factor, and mechanistic criteria of design.

2844. Postbuckling Behavior of Flat Plates, by J. R. Jombock and J. W. Clark. (ST) The essential features of postbuckling behavior of flat plates are described briefly, and concepts such as "effective width" and "crippling strength" are illustrated.

2845. Steel Frame Folded Plate Roof, by Oliver A. Baer. (ST) A development of space structures utilizing conventional framed trusses as basic units is analyzed.

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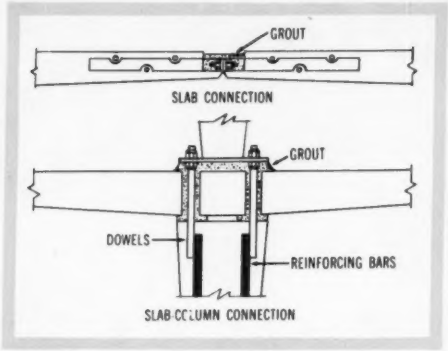

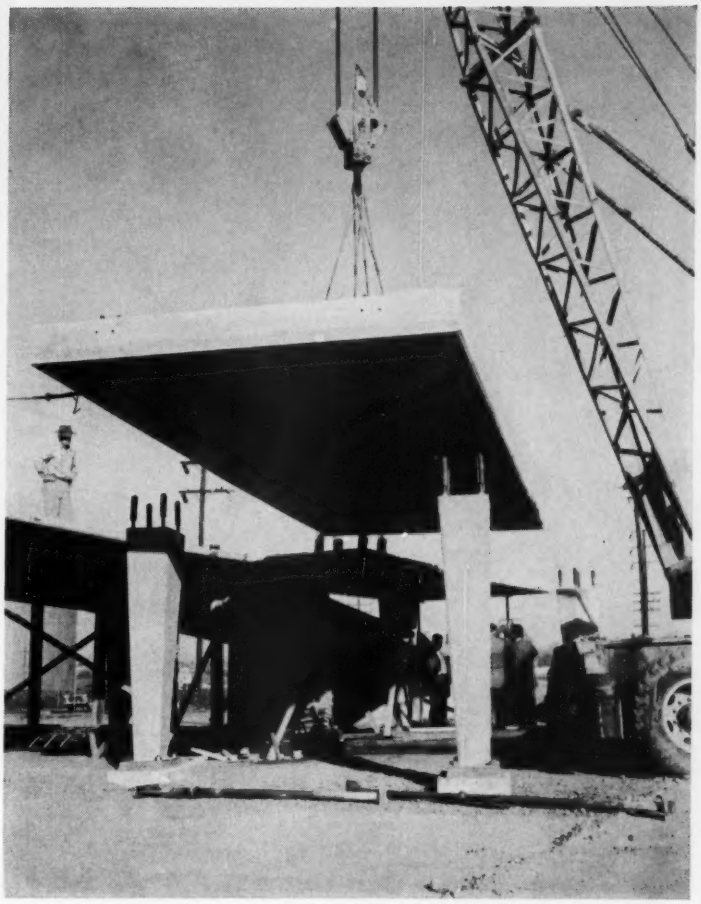

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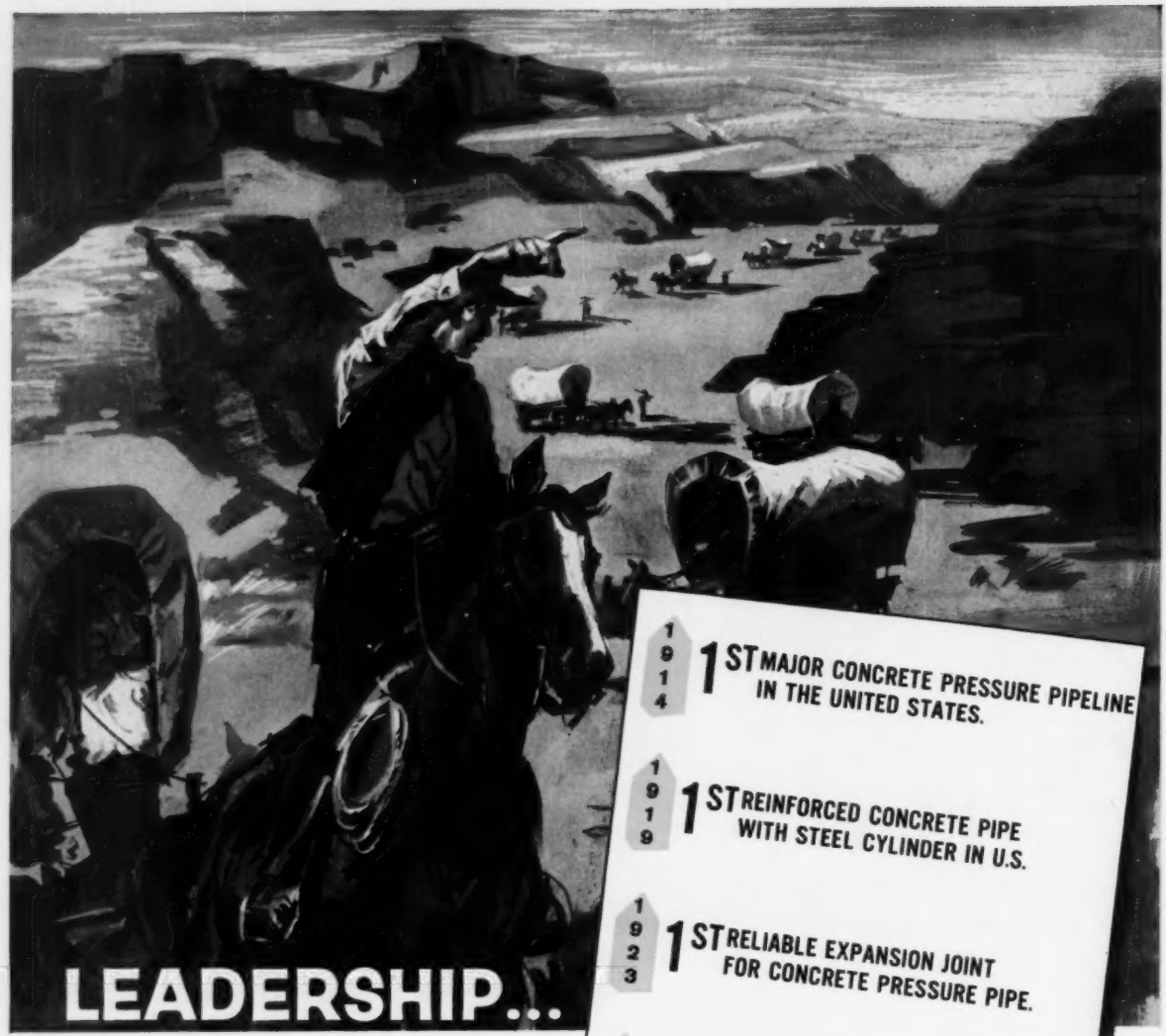

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